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OF THE

Royal Army Medical Corps

EDITED BY

COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

ASSISTED BY

LIEUT.-COLONEL D. HARVEY, C.M.G., R.A.M.C.

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Original Communications.

THE MOSQUITO PROBLEM IN BRITAIN:

SUGGESTIONS FOR A WINTER CAMPAIGN AGAINST THE IMPORTANT MOSQUITOES, WITH NOTES ON INSECTICIDES.

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I.—INTRODUCTION.

THE discovery of the rôle played by insects and other arthropods in the dissemination of diseases has provided one of the most important and one of the most romantic chapters in the history of scientific research during the past few years, and—naturally enough—it is to many workers in the Tropics that preventive medicine owes so much in its application of various remedies against insect-borne diseases both abroad and at home.

For this very reason there is a tendency, perhaps, to regard the question of malaria and mosquitoes in England at the present day too much from the tropical outlook and without sufficient regard to the altogether different political, physical and social conditions that exist at home.

In the following pages, therefore, we venture to suggest, and to give reasons for suggesting, that one of the recognized methods for reducing *Anopheline* mosquitoes, and thereby controlling the incidence of malaria, is likely to prove far more profitable at home than in tropical countries where, except under special circumstances, it is seldom used.

The appropriateness of the method in question was impressed upon us by noting some of the winter habits of mosquitoes when making, in 1917, a survey of the Aldershot Command; and, as it is based both in theory

and in practice upon facts of seasonal life-history exhibited specifically by the commoner British mosquitoes, it would be as well at once to review these facts.

II.—The Commoner British Mosquitoes and their Winter Habits.

As is well known, the *Culicidæ* is a family of the insect order *Diptera* or two-winged flies. The members of this large and cosmopolitan family are arranged by naturalists for the most part into two great groups, the *Culicines* and the *Anophelines*, and it is the *Anopheline* group of mosquitoes that provides the greatest interest to the medical officer because, so far as is known at present, it includes the only species capable of transmitting the malaria parasite.

It is rather remarkable, and at the same time fortunate for practical purposes, that the points of difference in the morphology and habits of the two chief groups of mosquitoes are not only well marked but hold good in greater or less degree for each stage of the insect's life. Thus, while the eggs of such a *Culicine* as *C. pipiens* are found in conspicuous blackish clusters ("rafts") in which the 100 to 200 cigar-shaped eggs float in a vertical position, the eggs of the *Anophelines* are generally placed singly on the water, or in reach of the water, and ultimately float in a horizontal position, being buoyed up by air cells that bulge laterally from the middle portion of either side of the egg.

The long respiratory siphons of the *Culicine* larvæ and the dependent positions of the latter from the surface film serve to distinguish them at once from the asiphonate *Anopheline* larvæ which, when combining respiration and feeding, adopt a rigid pose just beneath and parallel with the surface film. The young light-coloured *Culicines*, also, wriggle to the bottom when alarmed, whereas the little black *Anophelines* dart backwards across the surface to their hiding places among the rushes or less frequently sink passively to the deeper parts of their pool. As a general rule the *Culicine* larvæ seem to become darker with each instar, while the distinctive blackness of young *Anophelines* gives place in their later stages to varying shades of green and brown.

As regards the nymphs or pupæ a pocket lens will be necessary to see that the siphon tubes in the *Anophelines* are more trumpet-shaped and arise much further forward on the head than is the case with the *Culicines*.

When the fully developed insects are considered, the distinguishing with the naked eye of a male *Anopheline* from a male *Culicine* is not always an easy matter: the prominent head plumes which the male *Culicine* shares with the males of the *Anopheline* group tend to straighten its posture and make it resemble that of the *Anopheles*. Inspection of the captured insect with a low power of the microscope will at once remove all doubt and show whether the abdomen is clothed with both scales and hairs (= *Culicine*), or only with hairs and no scales (= *Anopheline*). In

the case of the females differentiation between the two main groups is easy, for while in the *Anophelines* the palpi (situated between the proboscis and the antennæ) are as long as the proboscis, in the *Culicines* they are much shorter and only project a little way beyond the head. The "legginess" of *Anophelines* as compared with *Culicines* is often noticed by the uninitiated and is certainly a distinctive feature which soon becomes obvious to those who mount specimens on disks. A male in either group can be quickly distinguished from a female by reason of the plumed antennæ and feathered palps that characterize the former; if these appendages are damaged the bifid character of the last abdominal segment of the male which is formed by the claspers will be in sharp contrast with the pointed extremity of the female. It may, perhaps, be repeated here that it is only the female mosquitoes of both groups that are fully capable, and in the habit, of piercing the integument of vertebrates and withdrawing blood.

Very valuable information concerning the specific features of British mosquitoes can be gleaned from the "Notes on the British Mosquitoes (*Culicidæ*)," published by F. W. Edwards in Nos. 590, 591 and 592 of the *Entomologist*. Suffice it to say here that the *Anopheline* group is represented by the malaria-carrying *A. maculipennis* and *A. bifurcatus*, and the rarer, non-incriminated, *A. nigripes* (*plumbeus*). The *Culicine* group according to Edwards comprises five genera, containing in all some fourteen species, and of these the more commonly found are *Culex pipiens* (common gnat), with its rufous thorax and very long first fork cell; the comparatively large and dull-winged *Theobaldias* (three species) and the wood-loving *Ochlerotatus nemorosus*.

There is increasing evidence to show that it is unwise to regard the many members of the mosquito family as being all alike and governed by the same impulses; for while, of course, these insects have many family characteristics in common, they also vary considerably in their individual tastes and behaviour. Thus, while some mosquitoes are only found in woods and forests away from the haunts of man, others seem to find the near presence of human beings essential to their well-being; among this latter class, too, the various species differ considerably in their conduct. Certain kinds, for instance, show a constant predilection for breeding places of a special type, so that it is comparatively easy to deal with their aquatic forms; in the case of other species which show a far more catholic taste in breeding places the destruction of larvæ is a correspondingly difficult matter.

As far as the northern half of the Aldershot Command is concerned, the species of mosquitoes most often seen are *C. pipiens*, *T. annulata*, *A. maculipennis* and *A. bifurcatus*. *C. pipiens* is by far the most common species, and during the summer months of 1917 barracks and houses were invaded by both sexes of this mosquito in enormous numbers. Its activities cease with the coming of winter when all the males presumably die off and

the surviving females betake themselves to cellars and outhouses where they hibernate. Judging from field observations and from laboratory experiments, there seems to be no disposition on the part of these *Culicines* to remain through the winter in a larval state.

The large, spotted-winged *T. annulata*, however, does not apparently go into complete retirement at the end of autumn, and from personal experiences and through other sources of information we find that this mosquito has been biting on and off throughout the winter. It is a particularly vicious biter and during the summer will take blood both indoors and in the open from dawn till sunset. During the winter its favourite time for attack seems to be just before dawn. As in the case of *C. pipiens*, females of *T. annulata* can be found throughout the winter in underground rooms and outhouses, but they appear to remain longer in the living rooms than do the other *Culicines* and they also seem to be more alert.

As regards the *Anophelines*, which are more shy than the *Culicines*, and which in the North Aldershot district are comparatively uncommon though widespread, there is a very striking difference in the conduct of the two species through the winter. In the summer and early autumn larvæ of *A. maculipennis* were constantly taken over a wide area, but repeated examinations of their breeding grounds since the middle of October, 1917, have invariably proved negative, while continued observations have shown that female adults have been quietly biding their time in cellars, stables, cow-byres and pigsties. It has been noticed also that *A. maculipennis* not only likes to rest high up on walls and ceilings, but shows a curious preference for the upper rooms of buildings.

On the other hand, while no adult specimens of *A. bifurcatus* have been seen in houses since the autumn, their larvæ have been persisting in natural breeding grounds and in the laboratory throughout the winter. Repeated examinations, since October, of one of the control breeding places have shown that the larvæ (no pupæ were seen during the winter) of *A. bifurcatus* can withstand severe frosts and in the laboratory they have been actually embedded in ice with no apparent ill effects.

Of the *Culicines*, *O. nemorosus*, too, appears to pass the winter in the larval state.

To recapitulate: Observations in the Aldershot district would seem to show that *A. maculipennis* and *C. pipiens* hibernate only as adults; *A. bifurcatus* and *O. nemorosus* only as larvæ, and that *T. annulata* live through the winter chiefly as adults, but possibly to some extent, also, as larvæ. Also, with one solitary exception, no male mosquitoes of any kind have been discovered during the winter.

While it is difficult to prove that, in the case of *A. maculipennis*, imperfect forms do not survive the winter as such in some way at present unknown, it may be mentioned that the experience of some other observers agrees with that gained at Aldershot; at this centre, too, experiments

which were conducted to determine if the aquatic forms of *A. maculipennis* sheltered themselves during the winter in any of the semi-solid surroundings of their pools, or in the deeper portions of the same, proved negative.

III.—Suggested Policy for Anti-Mosquito Work.

In view of what has been said in the preceding section it would seem reasonable to assume that, in the case of *A. maculipennis* and *C. pipiens*, the approach of winter sees the complete disappearance of the aquatic forms, while the task of continuing the species is left to the adults that are hiding in the houses and elsewhere. Further, as stated previously, these hibernating insects are all females and, what is more important, they are fertilized females pregnant with the possibilities of a future cycle of mosquitoes.

The truth of this latter statement seems to be strictly in keeping with what has been noted concerning the life-history of these insects: for, if these mosquitoes are not fertilized, to what end do they cling to life and brave the rigours of an English winter? For them the coming spring can hold out no prospect of courtship, since all their male contemporaries perished presumably with the passing of the summer's warmth and no other possible mates await them in the ponds and ditches which only contain the larval forms of another species. The reasonable explanation would appear to be that in the case of those mosquitoes that are found hibernating in cellars and other places mating took place late in the previous autumn or summer, that the males having completed their mission in life died, while the females, with their higher destiny still to be accomplished, prolong their existence through the winter until the time arrives when they can lay their eggs under conditions that are suitable for the development of their posthumous offspring. After producing their eggs these females, in all probability, die also.

In connexion with the question of these hibernating females being fertilized, the following notes from the laboratory records at Aldershot may prove interesting.

(*a*) *A. maculipennis*, female, No. 83, taken at Walldown, Whitehill, near Bordon, on February 27, 1918. Resting on wall of stable where a donkey was kept; at the time of capture abdomen distended with blood. Placed in breeding cage; deposited twenty eggs on March 20, 1918; eleven healthy larvæ hatched out on March 25, 1918.

(*b*) *A. maculipennis*, female, No. 107, taken from a cow-byre at Hale on March 20, 1918; abdomen distended with blood when caught; on March 28, 1918, twenty-three eggs were laid and from these twenty larvæ emerged on April 1, 1918.

These points in the life-history of the various mosquitoes to which reference has been made seem to us to be of much practical importance; for, in the case of the three commoner species, instead of extensive and continuous operations conducted after the winter is over, either against the imperfect forms which already have many natural enemies, or against the

adults which are then more widely disseminated and include many innocuous males, it would surely be better strategy to concentrate attention upon the cellars and other retreats during the winter when—to use slang—we have got the important insects "sitting." It may not be a very sportsman-like proceeding to attack them in these circumstances and in the close season too, but in the case of a dangerous pest whose numbers we wish to reduce as much as possible, the legitimate object is the destruction of the yet unborn and not their preservation as with game. Moreover, the destruction of one *Anopheles* nymph prevents the probable emergence of only one imago and this may not be a female; the killing of one fertilized female adult prevents the production of 50 to 100 eggs and at the very lowest estimate the number of imagines that are eventually produced from this batch of eggs will certainly be more than one.

Turning to *A. bifurcatus*, which in the Aldershot district is a much rarer species than *A. maculipennis*, it should, in the light of facts previously stated, be a comparatively easy matter to adopt in the case of this mosquito a form of differential treatment which should aim at destroying in the winter all the aquatic forms.

Ochlerotatus nemorosus, too, can be caught at a disadvantage if attention is paid in the winter or early spring to those woodland pools of brown and leaf-clogged water that are so popular with this species. (Such a pool, at Southampton, was treated just in time on April 20, 1918, for it was so densely populated with the pupæ of *O. nemorosus*—there were hardly any larvæ present—that the mere approach of footsteps caused the whole surface of the water to become agitated through the sudden scurrying to the bottom of the myriads of pupæ that were taking the air.)

In several of the wholesale methods of mosquito destruction to be described later the *Culicines* would often be destroyed together with the dangerous *Anophelines*, so that there should be a great diminution also in the numbers of the annoying gnats.

As the next section deals with the measures to be used exclusively against adult mosquitoes, it will be as well to clear the ground by briefly suggesting here a line of action in the case of *A. bifurcatus*. There are certain ways of distinguishing between the larvæ of *A. maculipennis* and those of *A. bifurcatus*, so that in a summer survey of a district certain ditches will have been noted as harbouring the larvæ of *A. bifurcatus* and will be earmarked for future treatment if necessary. But any *Anopheline* larvæ found in ditches after October may be assumed for all practical purposes to be those of *A. bifurcatus;* and if the records for the North Aldershot district, where only about six per cent. of the total *Anopheline* breeding places proved to be those of the rarer mosquito are at all comparable with records from other districts, it should not be a difficult or costly matter to deal very successfully in winter with the aquatic forms of *A. bifurcatus*. Without discussing the various anti-larval

methods which might be adopted—and each breeding place must be judged on its own merits—it may be just stated that, for limited collections of water, the application of direct larvicides might be preferable to oil films where the larvæ concerned can live for some days beneath a layer of ice. We have not been able to discover how such imprisoned larvæ manage to exist, but possibly they may tap the air spaces which are found under the frozen portion of water and in the ice itself; also, it is not absolutely proved that mosquito larvæ have no means of absorbing oxygen from the water, which in cold weather contains more of the gas in solution than in warm weather.

A larvicide which is recommended by the sanitary authorities of the Panama Canal Zone consists of carbolic acid, resin and caustic soda, and one part of this mixture is said to kill all larvæ in 5,000 parts of water in five minutes.

IV.—Measures for catching and killing Adult Mosquitoes.

We now propose to review some of the various remedies and methods that have been employed against adult mosquitoes, and it will be readily understood that the choice of any particular remedy must depend upon several considerations, such as the characters of the room or building in which the insects are hibernating and the kind of appliances that are available; while in each case the chief desideratum should be a method which is specifically efficacious, inexpensive and easily conducted.

The methods of catching and killing mosquitoes may be conveniently grouped as follows and with the majority of the measures described the writers are practically acquainted.

(*a*) Methods used for catching mosquitoes preparatory to killing them.
(*b*) Mechanical and physical methods of destruction.
(*c*) Fumigation methods.
(*d*) Spraying methods.

(*a*) *Methods for catching Mosquitoes preparatory to killing them.*

It will often be advisable during the carrying out of preventive measures, as well as in surveys and in mosquito research generally, to collect mosquitoes alive for various purposes, and this may be done in some of the following ways:—

(1) *Test-tube Method.*—All that is required is a simple test-tube and a steady hand to hold it. The insect must be approached by a stealthy and deliberate movement which aims at encircling the resting mosquito with the mouth of the test-tube, and this should be directed at right angles to the wall or ceiling upon which the mosquito is resting. Any temptation to "jab" at the quarry, when the test-tube is so near that escape seems impossible, must be resisted; the deliberately slow movement must be maintained to the very end or the insect will take fright and fly off. It is

wise also to see that if possible the hand throws no shadow on the wall near the mosquito. When a favourable opportunity occurs the tube is removed from its close contact with the wall and its mouth quickly closed in some suitable manner. A plug of cotton wool is the simplest artifice, and by confining the first caught mosquito close to the bottom of the tube three or four others may be caught and confined in the same tube each with an inter-cotton wool compartment to itself. If the insect is required for identification purposes, however, cotton wool should on no account be used as it damages some of the important diagnostic features; in this case the tube may be closed with a cork. The cork, too, should be cylindrical and not conical, in order that during its wanderings the mosquito may not become nipped between the cork and the sides of the tube; a metal cap also answers the purpose, and indeed the screw-capped tubes in which surgical ligatures are put up make capital catching weapons which have many advantages over the ordinary test-tube. It is advisable to keep one test-tube for each insect that requires careful scrutiny, but where the sole object is to catch and kill at once one tube is sufficient for all. The tubes can then be made lethal by means of a chloroform impregnated plug of cotton wool which is placed at the bottom of the tube, or one of the ligature tubes with air-tight cap can be made into a very neat combined catch-and-kill instrument by means of potassium cyanide and plaster of Paris.

The test-tube method is one worthy of more frequent use, since by this method alone a small room or tent can be quickly cleared of *Anophelines* that may be wanted for subsequent examination.

(2) *Nets.*—The ordinary entomological net is sometimes a great help and when mounted on a long handle is useful for catching mosquitoes that are not within reach for test-tube methods; a short-handled net, however, is more useful for general work. Nets are valuable weapons when it is required to catch mosquitoes in well-appointed rooms where other methods are contra-indicated; the second and third floors of a many-roomed house at Aldershot were cleared of practically all mosquitoes by the combined use of nets and tubes. For such wholesale work roughly made bags of butter muslin attached to handled rings are quite efficient, and when a bag is unpleasantly clogged with squashed mosquitoes it can be thrown away and replaced by a new one.

The use of catching nets might be encouraged, especially in light-coloured rooms where cases of malaria have occurred.

(3) *Traps.*—By a mosquito trap is usually meant a darkly lined box provided with a folding door or sliding shutter, and so placed in the open that mosquitoes may avail themselves of its pleasant shade during the heat of the day and pay for such hospitality with their lives before the evening draws on. It has occurred to one of us (G. R. B.) that, where the interior of military huts and other buildings are whitewashed throughout or are light-coloured, two simple box traps painted black inside or lined with

some black material would be useful placed high up at the corners of the door end of the room. A very brief daily inspection is all that would be needed, and if records were kept some valuable information regarding the seasonal variation in the numbers, species and sex of mosquitoes would be obtained.

But, as pointed out by Ross, various buildings found near dwelling-houses constitute natural mosquito traps; in Britain stables, cow-byres, pigsties, privies and coal sheds are very favourite haunts, while in the houses themselves cellars, cistern attics and the dark ends of corridors are places where mosquitoes chiefly congregate. All the places just mentioned —and many more might be cited—are summer resorts, though still potential mosquito traps. In winter, however, the hibernating species seem to prefer cellars and underground rooms to any other retreat. A certain amount of dampness is apparently necessary in the case of the *Culicines* and the re-starting of a stove or engine will clear mosquitoes from cellars that have been previously infested. But in the case of *Anophelines* dampness does not seem popular, and we have often seen such mosquitoes occupying only the dry parts of a cellar where the damp patches of the room were accurately defined by the sites selected by the *Culicines*. In the case of cellars, at any rate, there is not always that preference for dark-coloured surfaces which is so often mentioned with regard to mosquitoes; in one instance, over 100 specimens of *C. pipiens* were counted on a white portion of ceiling enclosed by two thick oak beams which were nearly black; on these beams only five mosquitoes were seen. It is highly probable that quite an appreciable number of wintering mosquitoes die in cellars without any human intervention, being killed off by cold, fungi, and probably also by the various representatives of cellar fauna.

To repeat, however, it is in underground rooms and outhouses that mosquitoes can be most easily attacked by human agencies and more particularly when such agencies are set going in mid-winter.

(*b*) *Mechanical and Physical Methods of Destruction.*

(1) *Swatting.*—This is the commonest means of self-protection and needs no explanation. A certain number of mosquitoes have undoubtedly been killed by this means and soldiers occupying corner beds of barrack-rooms have pointed out to us, on the walls, a gallery of mosquito remains with as much pride (and far more reason) as a gamekeeper will display his line of furred and feathered "vermin." But the disfiguring of walls in barracks and messrooms that often results from this method of summary retribution is a matter of some economical and sanitary importance, since it may necessitate renovations which would be otherwise unnecessary; in the case of hotels and boarding-houses it is also a matter that may give rise to some unpleasantness between the proprietor and his guests.

(2) *Flares or Blow-lamps.*—Noticing how many mosquitoes accidentally perished in the flame of the candle while we were examining cellars, it

occurred to us that possibly the insects might be deliberately destroyed by using the flame of a blow-lamp after the manner of painters. It may be said at once that the chief drawback to the blow-lamp method is the blow-lamp. It is not that the lamps are dangerous, but there is often difficulty in getting them to light, and, having been lit, the flame sometimes is apt to die away unless it is constantly stimulated by the air-pump. The method of lighting these lamps is as follows: With the valve open—the valve-tap is close to the filling aperture—the burner of the lamp is heated by wrapping its base (which encloses a nipple through which the paraffin is forced) with cotton waste soaked in spirit or paraffin, and this is then ignited. After the burner has been thoroughly heated the valve is closed and air is pumped into the lamp, when the spray of paraffin, which issues from a hole in the nipple, should ignite and produce a colourless flame about nine inches long. Failure to light generally means that the burner is not sufficiently hot to vaporize the paraffin, but without starting again from the beginning and with the cotton waste still alight a few vigorous pumpings will often get the lamp properly started. To maintain a steady flame it is very important to see that the washer of the screw cap which closes the filling aperture is efficient, and it saves time to remove at once the leather washer with which these lamps are sent out and substitute a wad of flawless cork. It is also necessary, from time to time, to make sure that no particle of dirt is obstructing the nipple aperture, and for this purpose there is provided a small piece of wire mounted on a handle. When in use the lamp is held by the wickered handle and by means of rapid traverses the mosquitoes are burned off the walls: obviously the use of such lamps is restricted to walls that are unfurnished and will not in themselves be injured by the flame. But cellars, closets, stables and other outhouses lend them selves to this form of treatment where the mosquitoes are concentrated in accessible positions, and it was also found that the lamp is more successful on cold days when the insects are unusually lethargic. One advantage of the blow-lamp is that various other insect pests are destroyed at the same time as the mosquitoes and, as a matter of fact, these lamps have been used to treat the walls of stables where mange has appeared.

(3) *Electrocution.*—In "More Minor Horrors" Shipley mentions that Howard records an instance of mosquitoes being curiously attracted by certain electric buzzings when the note of these reaches a certain number of vibrations per second. Advantage was taken of this fact by Mr. A. de P. Weaver, who made a piece of apparatus which charmed the mosquitoes by the note which it produced and at the same time electrocuted them. If English mosquitoes are equally influenced by electrical music, and if the necessary apparatus were both portable and inexpensive, there would seem to be a great deal in favour of electrocution as a clean, rapid and efficient method of destroying mosquitoes, even if it is only the males that are susceptible to these buzzings of electrical instruments.

(c) *Fumigation Methods.*

We have been much interested in a reference to W. Moore's experimental work on "The Volatility of Organic Compounds as an Index of the Toxicity of their Vapours to Insects," which occurs in the *Review of Applied Entomology*, Series B., vol. v, part ii, for November, 1917, p. 174. It is here stated: "The vapour present in the air is taken into the tracheæ of insects and is condensed upon reaching their finer divisions. Hence, if the compound is very volatile, it will evaporate and readily pass out of the insect, but if slightly volatile it will remain, penetrate the tissues and produce poisonous reactions. In higher animals, on the contrary, when the compound is taken into the lungs, it is rapidly removed by the blood and carried to all parts of the body, giving it an opportunity to react chemically on the tissues. In short, with the higher animals toxicity is more closely related to chemical composition than to volatility, the reverse being the case in insects."

This theory helps to explain what we have noticed practically for ourselves, namely, that the fumes of substances which are more or less unhurtful to human beings are more quickly toxic in the case of insects than those volatile products which are often so unbearable to humans and from the effects of which mosquitoes may ultimately recover.

(1) *Cresylic Acid Derivatives.* (*a*) *Cresol.*—In the "Mosquito" poster issued by the British Museum authorities, and in some text-books, cresol is recommended as an insectifuge; in our experiments with this substance it has been found that the fumes given off by heating cresol are very effective in *killing* mosquitoes.

The technique is simple and consists in placing the cresol in a shallow metal vessel, for the heating of which a "Beatrice" stove does admirably. The amount of liquor cresolis saponatus (official) necessary for each 1,000 cubic feet is four ounces, and there is no need to do more than close the doors and windows of the room to be fumigated.

Details of two actual experiments are given below:—

Experiment I.—Beer cellar (2,000 cubic feet) of hotel in which many mosquitoes were resting on the dark and damp walls, the great majority being specimens of *C. pipiens;* double doors at one end of the room and a window opening outwards into a shrubbery. Six specimens of *C. pipiens*, caged in a test tube which was plugged with crumpled paper, were also introduced into the cellar, the tube being suspended in a vertical position from the ceiling.

April 10, 1918, 11 a.m.: Heating of 112 cubic centimetres of cresol commenced. 12, noon: Vaporization ceased: room clouded with whitish fumes which did not prevent an entry being made for the purpose of putting out the stove. The caged insects which appeared to be dead were removed from the cellar and placed in the open air with the paper plugs partially removed. 2 p.m.: Caged insects undoubtedly dead. Atmosphere of room quite bearable, observations being made without opening the window.

Fifty mosquitoes and four large spiders, all in a helpless condition, were picked up from the sheet on the floor and removed in collecting bottles. Several apparently dead mosquitoes noted at the base of the walls. No smell evident in the bar above the cellar nor in any other part of the hotel, except in an adjoining cellar where a faintly antiseptic smell was noticeable. April 12: All the mosquitoes removed from the cellar were dead, but the spiders had recovered.

Experiment II.—Wine cellar of mess situated beneath the kitchen and separated therefrom by a very dilapidated partition, the planks of which were widely separated in places. These openings were roughly plugged with waste paper and a blanket was spread on the kitchen floor over the most deficient part. This cellar, measuring 2,052 cubic feet, was a notorious resort of *A. maculipennis* and *C. pipiens*. To the large number of free mosquitoes present at the time of the experiment there were added twelve specimens of *C. pipiens* caged in a gauze cylinder.

April 13, 1918, 3 p.m.; Vaporization of cresol commenced. 3.15 p.m.: Cellar full of pungent white gas. 3.40 p.m.: Vaporization ceased. 4 p.m.: Room entered and lamp put out; caged mosquitoes apparently dead. 4.15.: Several apparently dead mosquitoes noticed on the sheet. 4.30 p.m.: Door of cellar locked.

April 14, 11 a.m.: No living mosquitoes seen in cellar; over 500 dead collected from the sheet and from the wine-bottle shelves. No signs of life in the caged insects.

From these and other experiments it was found that the volatile products of "liq. cresol sap." are quickly given off, and that rooms are thoroughly permeated with fumes nocuous to mosquitoes, which invariably succumb within two hours of the commencement of operations. A person "holding his breath" can make an entry for the purpose of putting out the lamp in an hour from the time vaporization started. The room should then be locked up for another hour so as to make sure that all the mosquitoes pass from a stage of preliminary stupefaction to death. After two hours, in all, the windows can be opened and the room becomes fit for occupation in fifteen minutes' time, supposing that the amount of cresol used is in the proportion of 144 cubic centimetres to 1,000 cubic feet. The authors can thoroughly recommend cresol fumigation as an efficient method of killing mosquitoes, for in their experience it has never failed in its purpose. Cresol, too, is very generally available and nearly always finds a place in the sanitary equipment of the Army.

(*b*) *Cresol and Lysol.*—A mixture of equal parts of these two substances was used to fumigate the cellar of a private house in which mosquitoes were very prevalent; the ceiling of the cellar was defective in parts, and it was not possible to prevent altogether a leakage of gas into the drawing-room above. In other respects, too, the cellar did not lend itself well to fumigation, since the doorway was not provided with a door and the small single window was permanently sealed. A "Tommy's Cooker" was used

instead of a "Beatrice" stove, and acted quite satisfactorily, while the doorway was draped by a pair of heavy curtains. In this case, where the operation began at 3.30 p.m., the room was free from unpleasantness by 8 p.m., when all the mosquitoes (200 to 300) were found to be dead. The curtains effectually prevented the escape of gas through the doorway, and since this room could not be ventilated the disappearance of all unpleasantness by 8 p.m., seems quite satisfactory under the circumstances. There was a certain amount of leakage into the drawing-room, as was to be expected, but a visitor who had called during the operations was under the impression that the collie had been given a carbolic bath and she found the odour "rather pleasant than otherwise."

(c) *Creolin and Izal.*—In the Medical and Sanitary Report of the Gold Coast Colony for 1916, Dr. David Alexander describes some experiments which were carried out by the Medical Officer of Health Accra, (Dr. J. B. Alexander), who used creolin and izal as fumigating agents; creolin was first used, then izal, and finally a mixture of the two substances. The technique adopted is practically the same as that used by us in the case of cresol, but in Accra it was noted that, in order to prevent a deposit of soot, enamelled basins were preferable to those made of dull iron.

(2) *Chlorine.*—In the underground rooms of two large official houses at Aldershot chlorine gas has been used with great success in the following manner. From a cast-iron cylinder, in which liquid chlorine is confined under a pressure of 100 pounds to the square inch, the chlorine is released in powerful jets which are directed towards that portion of the room where mosquitoes are most abundant.

In the first experiments the chlorine, as it escaped, was collected as a boiling liquid in a graduated glass cylinder, and the cubic capacity of the room having been estimated, enough liquid chlorine was withdrawn to give a concentration, roughly, of 1 in 1,000, after the liquid had been thrown on the floor. This procedure, however, adds to the difficulties of the operation, and does not apparently confer any advantage. With a cylinder weighing sixty pounds (in addition to the sixty pounds of chlorine which an untapped one contains), and for a room of 1,000 cubic feet capacity, it is sufficient to give the tap a quarter turn for ten seconds, and if all the mosquitoes are not killed within a quarter of an hour the process should be repeated, when it is very unlikely that any insects will then be found alive.

Stringent precautions against the gas escaping from the cellars must be taken, and all exits, especially those situated low down, should be carefully sealed before the gas is released. Across the main exits from the cellar should be hung blankets or rugs which have been soaked in hyposulphite of soda ("hypo"); failing this, ordinary washing soda can be used, and, indeed, a well-damped blanket alone helps considerably as a barrier to the fumes.

When all the mosquitoes have been killed, the rooms must be ventilated as well as possible by opening the windows and other vents that communi-

cate with the outside. Clearing operations are helped by fanning the gas towards the windows, and by placing opposite the main exit a stove, lamp, or even a fire made of paper and straw, whereby a draught may be created.

It should be stated that all persons intimately concerned in these gassing operations should be provided with gas masks, and should know how to use them; an underground room, during the time that its exits must be kept carefully sealed, is not a pleasant place in which to be gassed, as one of us has reason to know.

Used as described above, chlorine is a powerful, rapid, and economic destructor of mosquitoes, but its use is attended by so many disadvantages that it is not likely to become generally popular. The disadvantages are:—

(1) The operators must be specially experienced.

(2) The outfit is cumbersome and heavy, two men being required to lift and carry a full cylinder. If, however, a much smaller cylinder (such as is carried by gassing officers for demonstration purposes) be used, much of this difficulty is overcome.

(3) The process is not unattended with risk.

(4) Much time and effort are necessary in order to clear the room of gas, unless the room in question is unusually well ventilated.

(5) Unsuitability for rooms that are furnished, and which contain immovable metallic objects.

(3) *Sulphur.*—This is one of the oldest and best known of insecticides, but the results of burning sulphur are often disappointing, probably from failure to observe some of the points in the technique. It is generally recommended that two pounds of sulphur are necessary for each thousand cubic feet, and it is an advantage in rooms of this size or over to divide the sulphur into half pounds, which should be evenly distributed at various points upon the floor. The sulphur may be burned in any shallow pan, placed on a tray of earth or upon a tin, which stands in a basin containing some water; the lighting of the sulphur is made easier if it is first sprinkled with a small quantity of paraffin or methylated spirit. All openings in the room must be carefully sealed in order to keep the concentration of the sulphur oxides as high as possible, and also to prevent the gas as well as the insects escaping from the room. It is, moreover, important that the room should not be opened too quickly, and we have found that good results obtain if the room is left undisturbed for twelve hours.

The cakes of sulphur which are put up in tins, and have wicks provided, have proved quite satisfactory, and can be bought at a small cost.

For operations on a large scale, and where time and scientific precision should be considered, the various forms of Clayton machines are undoubtedly valuable. Thus, at Accra a Clayton machine mounted on a bogie carriage is always kept ready for action, and has proved most useful for destroying mosquitoes in yellow fever epidemics, where factories and groups of native houses have to be fumigated as quickly as possible. Installed in

special boats these machines are probably the best agents for ridding ships of mosquitoes and other pests. For the routine treatment of louse-infected kit, the Clayton machine is being used in some military centres, and in the following table are shown the results of an experiment (carried out at the Embarkation Rest Camp, Southampton), in which mosquitoes and other flies were first imprisoned in test tubes, and then placed in a hut where blankets were being fumigated with a Clayton machine. The insects remained in the hut for sixteen hours, and during the time that the Clayton was at work the approximate percentage of sulphur dioxide was three per cent.

Insect	How caged	Where placed	Result
Culex pipiens	Test tube capped with gauze ..	Near ceiling of hut ..	Killed
Ochlerotatus nemorosus	,, ,, plugged with paper ..	,, ,, ,, ..	,,
Chironomus sp. ..	,, ,, plugged with gauze ..	,, ,, ,, ..	,,
Anopheles bifurcatus ..	,, ,, plugged with wool ..	,, ,, ,, ..	,,
O. nemorosus	,, ,, capped with gauze ..	On floor close to door ..	Still alive after 16 hours
Musca domestica ..	,, ,, plugged with wool ..	On beam near ceiling ..	Killed
Fannia sp.	,, ,, plugged with paper ..	,, ,, ,, ..	,,
O. nemorosus	,, ,, plugged with gauze ..	,, ,, ,, ..	,,
,, ...	,, ,, capped with gauze ..	,, ,, ,, ..	,,
,, ...	,, ,, plugged with wool ..	In a fold of blanket ..	,,
,, ...	,, ,, plugged with gauze ..	Near door, but half-way between floor and ceiling	,,
Chironomus sp. ..	,, ,, plugged with paper ..	,, ,,	,,

The machine in this case is lightly constructed, and can be carried by two men; it is air cooled and capable of saturating 6,000 cubic feet per hour with a fifteen per cent strength of gas.

One of the chief characteristics of all forms of Clayton machines lies in the fact that they ensure movement of the atmosphere in the room to be fumigated, and by means of a suction hose air is constantly being abstracted from the room and, after passing through the generator and being mixed with sulphur dioxide gas, is reintroduced by means of the delivery hose. Another advantage of these machines is that they can be provided with a ventilating attachment so that rooms may be cleared more quickly than would be otherwise possible.

Where the rooms are comparatively empty the makers recommend that the suction pipe should be introduced near the top of the room and the supply pipe at the bottom; in the case of holds and other compartments which are more or less blocked with goods or furniture the relative position of the two hose pipes should be reversed.

The disadvantages of sulphur as a fumigant are chiefly connected with the care necessary in the preparation of the room to be fumigated—especially where this room is one of many in a private residence—and with the damage to metals and fabrics that sometimes follows exposure to

the fumes; but the ill-effects of sulphur in this direction have perhaps been over-emphasized and we have found that linen and cotton fabrics if wrapped in paper and put away in drawers suffer no visible harm; carpets, curtains and other coloured articles will not be bleached provided they are perfectly dry. It is advisable, of course, that all articles of clothing and furniture should be taken from a recently fumigated room and well aired either out of doors or in a dry and thoroughly ventilated room.

As regards metallic objects it is best to remove from the room all such as are readily portable and delicately fashioned, while the fixtures, including finger plates, door handles, electric fittings, &c., may be protected by a coating of vaseline.

Tinned provisions which are well sealed suffer no harm, but fresh foods will be unpleasantly contaminated if left exposed; flour and grain are said to be peculiarly susceptible to the action of sulphur.

(4) "*Sulphume.*"—This is a proprietary preparation of liquid sulphur dioxide which is put up in metal cylinders holding about twenty fluid ounces, and one such cylinder is said to be sufficient for the fumigating of 1,728 cubic feet of air; the room to be fumigated must be sealed as in the other forms of sulphur. The directions state further that, after the leaden vent pipe has been quickly cut through with a knife, the cylinder should be placed on a moistened towel (contained in an earthenware vessel) in such a way that the vent pipe is pressed into the towel, the dampness of which assists in hydrating the gas.

Following these directions we experimented with "sulphume" in a room with a cubic capacity of 1,175 cubic feet. The cutting of the lead vent was at once followed by the gushing out of gas, with the sound of steam at high pressure, and the cylinder having been deposited on the towel the cellar exit was carefully sealed. According to the circular the liquid sulphur dioxide in such a cylinder takes about twenty minutes to evaporate, and a re-entry to the room can be safely made in eight hours. Being anxious, however, to ascertain how the toxicity (in point of time) of "sulphume" compared with that of other fumigants, the room was inspected after two hours. It was found that the smell of sulphur was very slight and that throat irritation only occurred in bending down close to the towel. The cylinder was found to be empty and frozen to the towel, which was also stiff. There was a patch of sulphur dioxide "snow" near the pipe of the cylinder and from this "snow" gas was slowly issuing.

The effect on the mosquitoes was very slight; the usual inhabitants of the room were flying about freely, while those which had been introduced in gauze-capped test tubes seemed quite active and normal.

This particular cylinder of "sulphume," therefore, was of little good as a culicide when used as above described, and since after two hours' sealing it was possible to stay in the room without any discomfort, it was improbable that the atmosphere would have become more toxic to the mosquitoes if a longer time had elapsed before unsealing the room. It is only fair

to add that the particular cylinder used on this occasion had not been recently obtained from the makers.

(5) *Formic Acid.*—If commercial formalin (forty per cent. formic-aldehyde) and potassium permanganate be brought together formic acid fumes are liberated and these are toxic to mosquitoes.

In 1917 the linen room of the Connaught Hospital, Aldershot, was completely cleared of mosquitoes in the following way. Into a bucket containing between one and two pints of water was placed a good-sized handful of potassium permanganate crystals (a "handful" of the salt weighs about ten ounces) and over this was poured a pint of formalin. A brisk evolution of gas was immediately started. Fumigation began at 10 a.m. and the doors were simply locked and not sealed. An entry to the room was made at 4 p.m. when the windows were opened. Hundreds of mosquitoes were to be seen dead on the floor and shelves.

The proportion of the reagents required for 1,000 cubic feet is approximately ten ounces of potassium permanganate to one pint of formalin.

A distinct advantage of this method of killing mosquitoes is that no heating apparatus is required, so that there can be no danger of fire through inattentive observation; a room can be simply locked up and left till the time for reopening. Formic acid also is harmless to the furniture.

There are on the market cakes of potassium permanganate which are sold with the requisite amount of formalin put up in tins, but our experiments with these trade products proved disappointing; here again the reagents may have become inert through keeping.

(6) *Formalin.*—This is an acknowledged deterrent in the case of flies generally; so far, however, we have not found it of much use in *killing* mosquitoes. An account of some formalin spray experiments is given in a subsequent section.

(7) *Campho-phenique.*—Under this name a mixture of camphor and phenol is, in America, placed high among successful insecticides, and a special piece of apparatus has been designed for using the mixture as a fumigant. There is nothing very difficult in the technique, however, so long as measures are taken to prevent the mixture burning. Equal parts by weight of macerated camphor and pure carbolic crystals are mixed and liquefied by warming. The resulting dark liquid is then gently heated in a shallow pan with inverted edges over a spirit lamp, the flame of which should be protected from draughts by a circular baffle. Two ounces of each ingredient are sufficient for a room of 1,000 cubic feet capacity and the room should be kept closed for two hours. In some experiments which were carried out by the Sanitary Branch of the Gold Coast Medical Department it was found that campho-phenique was just as efficient as sulphur and was a far more pleasant agent with which to work. The fumes are not disagreeable; the room can be used within an hour of stopping operations and, unlike sulphur, the substance has no harmful effect upon metals and fabrics; as an advertisement might run, "it is

an elegant preparation and highly to be recommended for well-appointed rooms."

(8) *Hydrocyanic Acid.*—In the familiar killing bottle as used by entomologists, and which provides perhaps the best poison for mosquitoes that are to be examined and set, the fumes of prussic acid, so long as the chemicals are not too old, act well. Doubtless hydrocyanic acid would be also efficacious if used on a large scale against mosquitoes, as it is in the case of some other disease-carrying arthropods, but it is too dangerous a remedy to use where other safer ones are quite efficient.

(9) *Chloroform.*—This substance is a very serviceable insecticide in the case of mosquitoes caught in test-tubes or by the trap method, but its cost, quite apart from other considerations, debars it from being used as a general insecticide. Where it is intended to set any insects that have been treated with chloroform care should be taken to see that they have been really killed and not merely narcotized, for in the absence of such precautions a mosquito has an unpleasant habit of "coming round from the anæsthetic" and adopting a position on the disk very different from that which was given it when put into the store box.

(10) *Tobacco.*—For mosquitoes enclosed in bottles or test-tubes the occasions will be few when it is not possible to kill them with the fumes from a pipe or cigarette. They readily succumb to this simple expedient and are so susceptible to the presence of tobacco smoke that pipes and cigarettes should be put out when important captures by the test-tube method are in progress.

(11) *Keating's Powder and Pyrethrum.*—We were not able to secure sufficient quantities of these substances to make any trustworthy experiments. There is no doubt that the fumes given off by heating pyrethrum powder or "Keating's" are not liked by mosquitoes and that insects can be driven from a room by these methods. Keating's powder is too heavy for purposes of insufflation, but New Zealand medical officers speak enthusiastically of a pyrethrum preparation sold under the name of "Mortine," with which bedrooms, and night nurseries particularly, are insufflated before being occupied. It is said that in this way the great majority of mosquitoes are very soon brought down in a helpless condition and may then be swept up and destroyed.

(12) *Fumigen.*—This is a proprietary preparation put up in the form of cones and sold by florists for the purpose of destroying thrips and other greenhouse pests. The cone after being ignited burns slowly from the apex downwards with a not unpleasant smell; the effect on mosquitoes, in the only experiment we made, was nil.

(*d*) *Spraying Methods.*

It is open to question whether the methods of attacking mosquitoes by various sprays should not have been discussed under the previous heading, "Mechanical and Physical Methods of Destruction." Given a well-illuminated room on the light-coloured walls of which mosquitoes are

closely compacted, a good many insects can be brought down by carefully directed fire from a hand syringe, using water only. In such tactics, however, success seems to depend upon the battering effect of the forcibly expelled water, such as occurs when a hose is turned on a hostile mob. In the case of mosquitoes which are subjected to the fire from a hand syringe, such as a "Mackenzie sprayer," we have found that a large number of insects take to flight when the firing begins and that of those brought down a large number recover unless quickly swept up and otherwise destroyed.

With a view to supplementing the purely mechanical effects of water sprays, we have conducted, and watched others conduct, experiments in which commercial formalin was mixed with water in the proportion of one to forty. The chief effect of using this spraying mixture is that the insects are more quickly constrained to take flight, so that "pot shots" soon become impossible and indiscriminate firing at active mosquitoes on the wing is a waste of time.

In the Cameroons, spraying with formalin solutions was adopted as a method of dealing with mosquitoes in grass huts whose inflammability precluded the use of fumigants. It was subsequently found by Giemsa (who reported on the use of sprays in the Cameroons) that the action of formalin and other culicifuge substances was considerably enhanced if, instead of water, various soap solutions were used as the spraying medium. In some experiments carried out at Hamburg by the same observer it was shown that when used in this way the formalin could be reduced to a proportion which had no markedly unpleasant effect on the human air passages. Moreover, it was suggested that soap solutions by themselves possessed insecticidal properties when used in certain strengths; possibly these solutions act by lowering the surface tension of the insect's cuticle and so make them more vulnerable.

Using as a basis the formula of Giemsa, as catalogued in the *Review of Applied Entomology*, vol. ii, May 1914, p. 81, a Winchester quart bottle ($4\frac{2}{3}$ pints) of soap solution was first prepared by allowing $1\frac{1}{3}$ ounces of the common carbolic soap (as used in the Army) in $4\frac{2}{3}$ pints of water derived from the Bourley reservoirs, Aldershot; on standing a little while this solution was found to be "jellified," and the same thing happened when half the strength of soap was used. Finally, it was found that $\frac{1}{3}$ ounce of soap to $4\frac{2}{3}$ pints of soft water produced a permanent liquid which lathered well on shaking. Three experiments are described below:—

Experiment I.—With a "Levick steam sprayer" $2\frac{1}{2}$ pints of soap solution, prepared as described above, were sprayed into a room of 500 cubic feet capacity and in which was hung a perforated zinc cage containing twenty-nine *C. pipiens* insects and one *A. maculipennis*; doors of room were closed but not sealed.

April 18, 1918, 2 p.m.: Steam atomization of soap solution started. 2.20 p.m.: All mosquitoes alive, cage brought to within three feet of jet.

2.25 p.m.: Solution completely atomized; mosquitoes adhering to sides of cage except one which was walking about. 2.45 p.m.: Mosquitoes removed from cage, placed on dry cardboard and covered with large Petri dish. 2.50 p.m.: All mosquitoes, except four, exhibited lively movements of legs. 5.45 p.m.: *Anopheles* on the wing; nine *Culicines* seemed quite comfortable, remainder *hors de combat*. 8 p.m.: Same as at 5.45.

April 19, 1918, 7.30 a.m.: The *Anopheles* and four of the original twenty-nine *Culicines* still living, but in a torpid condition. N.B.—There was a hard frost during the night, 1 p.m.: All mosquitoes dead.

Experiment II.—In this experiment the mosquitoes were attacked under more natural conditions, since the insects on this occasion were assembled to the number of 150 in the meat cellar (648 cubic feet capacity) of a W.A.A.C. hostel. The room, recently whitewashed, contained a door with perforated zinc panels and a window with broken panes of glass. The spraying solution consisted of fifty cubic centimetres of commercial formalin mixed with 4⅞ pints of soap solution prepared as for Experiment I. The gaps in the window panes were closed with sacking and by means of a "Mackenzie sprayer" the walls and ceilings were then sprayed for ten minutes.

April 20, 1918, 11 a.m.: Spraying commenced, both sprayer and the W.A.A.C. assistant, who was pumping, being in the room; insects at once took wing. 11.5 a.m.: Pumping assistant had to retire from room owing to irritating effect of fumes. 11.10 a.m.: Spraying continued, sprayer remaining in the room while assistant was stationed outside, the door being kept sufficiently ajar to allow passage of delivery tube. 11.15 a.m.: Apparatus removed, door closed. 11.45 a.m.: Room inspected; smell of formalin quite perceptible but bearable. Five *Culicines* resting apparently at ease on the streaming walls; they took flight on being touched. Remaining mosquitoes not seen—dead or alive; some were probably hiding, others no doubt had escaped through the doorway.

April 24, 1918, 2 p.m.: Room smelling slightly of formalin; ten active mosquitoes seen.

In this experiment it is probable that the apparent reduction of mosquitoes in the room after it had been sprayed was due to the fact that many of the insects were driven out through the slightly open doorway and possibly some of these have eventually died. Further observations with formalin and soap solution were attempted in the case of some outhouses, but definite conclusions in these places are not easily obtained owing to the deficient light and the difficulties in using artificial illumination. It was found, however, that in spraying outhouses and sheds there was an advantage in remaining outside the outhouse and aiming at the doorway or window opening; in this way the disturbed mosquitoes are not only driven out from the room but a certain number are brought down as they fly towards the exits and into the spray.

Experiment III.—In April, 1918, we were kindly allowed to use the

mobile spraying machine which was introduced at Aldershot for the purpose of spraying cerebrospinal fever "contacts." The room selected was an empty cellar of a vacated cavalry mess and at the time of the experiment it contained about 100 mosquitoes: the dimensions of the room were 1,000 cubic feet, approximately, and in addition to a small ventilator, which was plugged with sacking during the experiment, the door was panelled with perforated zinc. The room was fitted up exactly as for throat spraying, but instead of the usual zinc sulphate solution a mixture of equal parts of cresol and water was employed. Two hundred cubic centimetres of this mixture were placed in each of the two jars and the steam having been turned on under a pressure of sixty pounds, the two jets were allowed to play for fifteen minutes. At the end of this time the steam was turned off and the room immediately entered, when it was found that the atmosphere, though extremely humid, was otherwise quite bearable. After opening the door the vapours quickly dissipated and inspection showed that all the mosquitoes which were visible had certainly been put out of action for the time being; some were quite dead and these were chiefly found on the floor. In the case of others which seemed half "drowned," and on whose bodies the impregnated steam had condensed in minute droplets, it seemed doubtful whether recovery was possible. It is open to question whether in this experiment the cresol had much, if any, toxic effect, and perhaps similar results might have followed the use of steam alone. Unfortunately, it was not possible to follow up the after results of this experiment nor to conduct others of the same nature.

V.—Summary.

(1) The methods for controlling malaria in the United Kingdom under present military conditions must often differ from those adopted as part of a settled policy in those tropical Colonies where malaria is endemic and where the social conditions are so profoundly different.

(2) It happens that in England the most prevalent of the malaria-carrying mosquitoes, *Anopheles maculipennis*, and the commonest species of the *Culicine* pests, *Culex pipiens*, both pass the winter as adults. The females of both these species may be found during the winter months in cellars, cow-byres, pigsties, stables and outhouses generally.

(3) Of the other two *Anopheline* mosquitoes found in Britain only *Anopheles bifurcatus* is seen at all frequently in human habitations and this species passes the winter in the larval stage.

(4) The winter, rather than the summer, therefore, would appear to be the best time for dealing with the two important species of *Anopheles* as well as with the chief *Culicine* pest.

(5) The selection of any special insecticide must be guided by considering the nature of the building or room to be treated, the means at one's disposal and the convenience of all concerned; in any case the

requirements of a good insecticide are that it should be efficient, inexpensive, and easily managed.

(6) The combined use of the test tube and entomological net deserves more recognition, especially where it is desired to catch, and perhaps examine, the mosquitoes in rooms, tents and huts from which malaria cases have been recently removed.

(7) Artificial traps are not necessary in Britain, except for scientific observations and experimental purposes, since the various winter resorts as mentioned above act as natural traps. The fact, too, that the hibernating mosquitoes leave the better appointed parts of a house on the approach of winter and congregate in cellars and outhouses provides another reason for attacking these insects in winter, since the difficulties in fumigating such places are much less than in the case of a well-furnished dwelling room.

(8) As regards fumigants the general use of hydrocyanic acid, chloroform, and chlorine on a large scale is not recommended on account of the dangers attending their employment. At the same time chlorine is a very powerful insecticide and does its work quickly, so that, in stations where this substance is available and where the services of gas officers can be obtained, it might be used with very good results and at small cost.

The employment of sulphur, in our opinion, is indicated only when the gases can be introduced by a Clayton machine and where the rooms to be fumigated do not contain articles that are affected by sulphur dioxide. The portable machines as found in some stations might well be used for the wholesale destruction of mosquitoes and other insects in rooms that can be sealed, but the burning of sulphur in pans is not nearly so satisfactory as the employment of various other fumigants.

Formalin is a popular remedy with many. Strong solutions have to be used, however, in order to kill mosquitoes; and even then the process takes a long time, because the chitinous exo-skeleton of insects protects them considerably from those inflammatory reactions which are so quickly set up by its action on the skin of soft-bodied animals and on the mucous membrane of vertebrates. Formalin is an unpleasant substance with which to work; while the after-use of ammonia, though obviating some of the drawbacks, adds to the details of the technique.

Fumigation with campho-phenique and the various cresylic compounds offers, in our opinion, many advantages, especially where the desideratum is a safe domestic remedy. The necessary technique is simple; the fumes given off by these substances act efficiently and fairly quickly; there is apparently no damage to furniture and fittings as a result of their use, and the smell they emit, while never wholly unbearable, quickly passes away altogether. For these reasons campho-phenique and the cresylic compounds can be used in dwelling rooms where other methods are contra-indicated.

Spraying methods do not seem to us to offer any advantages over fumigation where barracks and rooms in the United Kingdom are concerned. Spraying is a messy operation in any case and for that reason alone often

inadmissible; it involves the use of special apparatus and the careful attention of the operator; most important of all, it is extremely doubtful whether it is an efficient method.

VI.—Conclusion.

The opinions expressed in this article are based on the tropical experience of one of the writers and upon mosquito research work carried out by both at military stations in England during the past twelve months. These opinions, of course, are not intended to be in any sense final, but such as they are it was thought that they might be put on record in advance of the coming winter. Notes of experimental work have been included in order to draw attention to one aspect of anti-malaria work and perhaps provoke further inquiry as to the best methods for destroying adult mosquitoes in Britain.

ADDENDUM.

Since the preparation of this paper, one of us (G. R. B.) has been making further experiments in fumigation methods and in consequence wishes to insert the following additional rules of technique for the employment of cresol.

(1) Paraffin stoves of the "Beatrice" type must be used, i.e., stoves in which the flame is guarded by a metal chimney having a mica window let into one side for observation purposes; such stoves also have metal gratings at the top for use in cooking operations.

(2) The flame of the stove should always be kept quite low during the process of fumigation.

(3) The cresol to be vaporized should be placed in some enamelled receptacle which should completely cover the grating on which it rests; the receptacle in fact should be as large and deep as possible so long as its position is secure. A flat bottomed hand basin or a deep soup plate both of enamelled ware, answer the purpose.

(4) Constant observation is always necessary and a bucket of water should be at hand in the event of the cresol catching fire; but there is no chance of this happening if care is exercised and the above rules are observed.

(5) One operator can fumigate two rooms simultaneously with two stoves, provided the rooms are on the same landing and close to one another so that observation can be given to both equally. However, it is as well for one operator not to attempt fumigating more than two rooms at the same time.

(6) Generally speaking, the flame of the stove can be put out in half an hour's time (the time varies more or less according to the size of the room and the amount of cresol used), after which the doors of the rooms should be locked and the fumes of cresol "bottled up" for another hour and a half so that there is a certainty of the insects passing from a preliminary stage of stupefaction to death.

NOTES ON GUNSHOT FRACTURES OF THE FEMUR.

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The following observations were made from a series of 155 cases of gunshot fracture of femur, admitted between the period January 1, 1918, to August 14, 1918.

The statistical statement gives an outline of the cases dealt with. The number of cases of gas gangrene is large, and is accounted for by the fact that during the actions in March, April and June, the cases were frequently forwarded without previous operative treatment and were a considerable time in transit.

Total admissions	155
,, deaths	22 = 14·19 per cent
,, cases of gas gangrene	21
,, cases with involvement of knee-joint	14
,, cases with other wounds	35
Number of amputations	15
Deaths from gas gangrene	13
Average shortening	6 millimetres

The influence of the causative agent on the type of fracture, degree of tissue damage, and degree of infection is very great. Those caused by long range, high velocity bullets which produce a small, punctured skin wound at the point of entry are much less serious than those caused by large, ragged projectiles, or low velocity bullets. Unfortunately, the latter are much more common in modern warfare. In the former type, clothing and gross foreign material are rarely carried into the wound, hence the infection is less virulent, the soft tissue damage is slighter and the splintering of the bone less severe. In the latter type, the missile frequently carries with it large portions of highly infected foreign matter, and these, if allowed to remain for even a short period, form an admirable nidus for the development of organisms.

All types of fracture occur, but the much comminuted variety is by far the commonest. The smaller fragments, being detached from the periosteum, act as foreign bodies.

Site of Fracture.—The old arrangement of fractures of the femur into those of the upper, middle and lower thirds remains the most convenient for descriptive purposes.

It has been found, in a general way, that it is best for all three sites to apply extension in a varying degree of the same position, i.e., abduction and semi-flexion of the hip and flexion of the knee.

The upper fragment being difficult to control by splinting, it follows that the lower fragment must be aligned with it, and that the extending force must be in the direction of the long axis of the upper fragment.

The displacement in gunshot fractures is similar to that occurring in simple fractures, but is frequently modified by the enormous tissue damage received at the time of injury. This modification, being due to muscle destruction, is usually in the direction of minimizing the tendency to displacement after reduction has been effected.

All types of fracture may be treated on the apparatus here described, and treatment should result in a limb of normal length and contour, except when the damage has been so gross as to cause total destruction of a large portion of bone and periosteum.

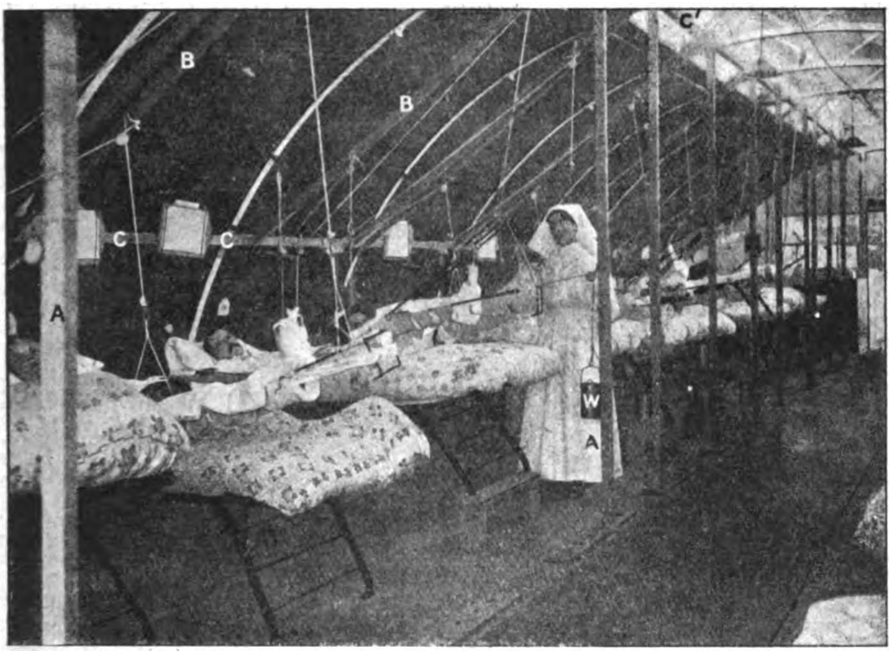


FIG. 1.—Showing (A) extension poles, (B) suspension poles, (C) and (C′) supporting beams, (W) extension weight. The apparatus is here adapted to the Nissen hut.

As fig. 1 shows, the apparatus consists essentially of an adjustable vertical extension pole (A) and of suspension poles running parallel to the long axis of the bed, which are adjustable laterally (B). The extension and suspension poles are laterally adjustable upon two beams running the entire length of the ward (C) and (C′). The suspension poles are notched to prevent any slipping of the suspension pulleys. The extension pole is perforated with holes two inches apart through which the cord of the pulley block is secured. In this way a pull may be obtained from any

point, in any direction, and of any weight which may be required to reduce the fracture. The apparatus permits of great accessibility to the beds, as there are no floor supports, and the suspension beams are sufficiently high to prevent inconvenience whilst the patient is receiving attention. This system can be readily adapted to any type of building, and will carry any type of splint.

Splints.—In our opinion the most useful of all splints for the treatment of fractures of the femur is the medium ring Thomas splint. It has the advantage over every other type which we have used of enabling the surgeon to retain the fragments in absolute apposition once the fracture

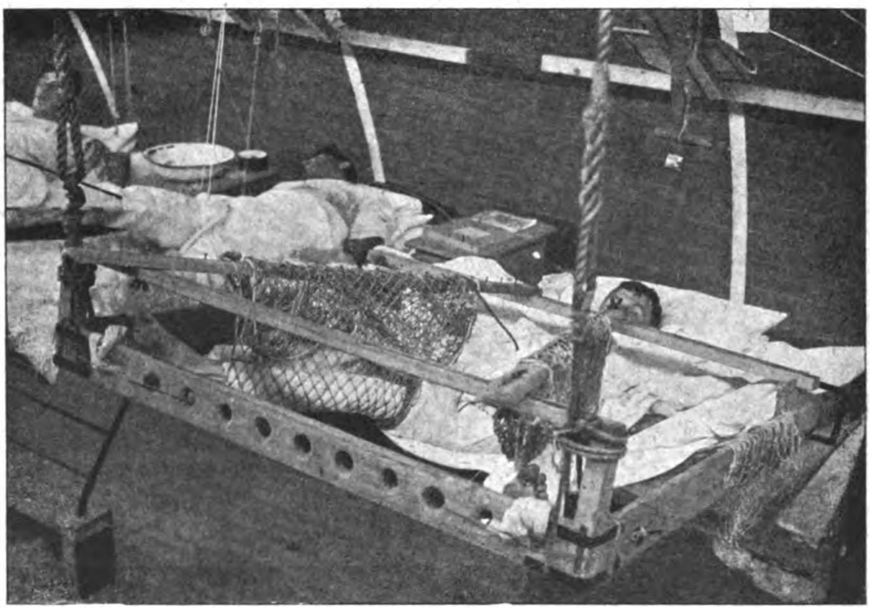


FIG. 2.—Sinclair net bed.

has been aligned. On a well-applied Thomas splint, dressings may be done, weights altered, the patient nursed and even small operations performed—such as removal of sequestra—without the extension being in any way relaxed. The only fractures in which it is not successful are those in which there are high buttock or perineal wounds. In these cases we have found the Sinclair net bed (fig. 2) extremely useful, especially as it can be readily slung from the suspension apparatus in use. We also use for these high wounds a form of section bed after the pattern devised by Major Pearson, R.A.M.C. Combined with this section bed we have employed a double abduction apparatus (fig. 3). The bar (A) is bolted to the frame of the bed on each side. It is of ½-in. flat iron. Pivoted to

this bar is the suspension frame into which the limbs are slung by means of two large towels. The frames can be raised to suit any degree of flexion of the thigh, or abducted to any angle. The rotation of the limb is controlled by means of foot suspension. When this frame is used the bed is elevated at the foot and the limb fixed to the extension pole, the body weight acting as the extending force. The wounds are dressed and the patient attended to by removing the underlying section of the bed (fig. 4).

Hodgen's splint is useful in some high fractures, but possesses the disadvantage of rendering the fragments mobile when the upper slings are removed for dressing purposes. When Hodgen's splint is used, the utmost care must be exercised should it be necessary to transport the patient to the operating theatre.

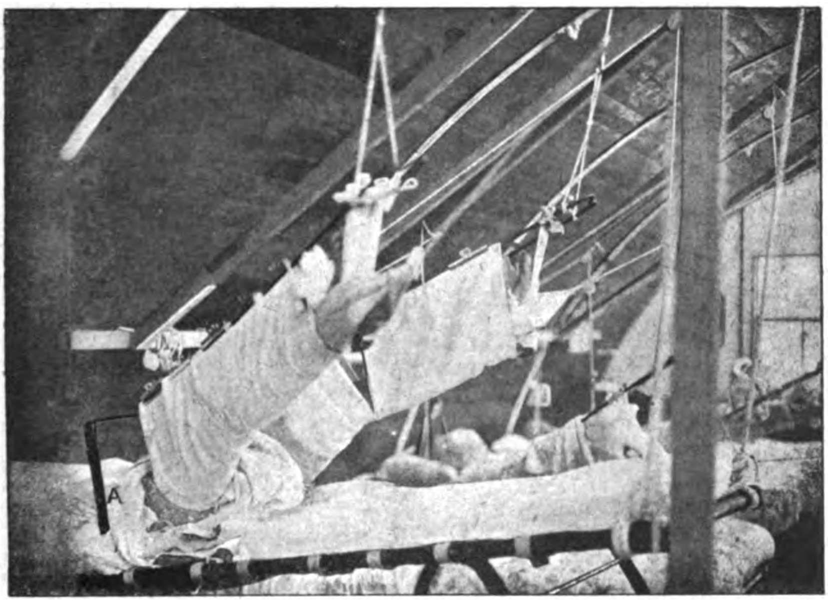


FIG. 3.—Showing double abduction frame and (A) bar bolted to frame of bed.

Methods of Extension.—The vast majority of cases are forwarded from the Casualty Clearing Station with strips of adhesive plaster or gauze glued and bandaged to the limb for purposes of extension. For transport this is an excellent routine measure.

Glue extension has, however, the disadvantage of frequently producing blistering and occasionally sloughing of the skin. In many cases this is due to impurities in the glue or to faulty application, but even where the greatest care is possible, the accident remains of common occurrence. Further, this being an indirect method of applying traction to the femur,

a greater weight must be used to maintain alignment of the fragments than when one of the more direct procedures is employed.

For these reasons we prefer the calliper extension applied to the condyles of the femur, but they should not be used where there are wounds in the lower third of thigh on account of the difficulty of maintaining asepsis. They should be introduced through a small punctured wound made with a tenotomy knife in order to effect a watertight junction at the

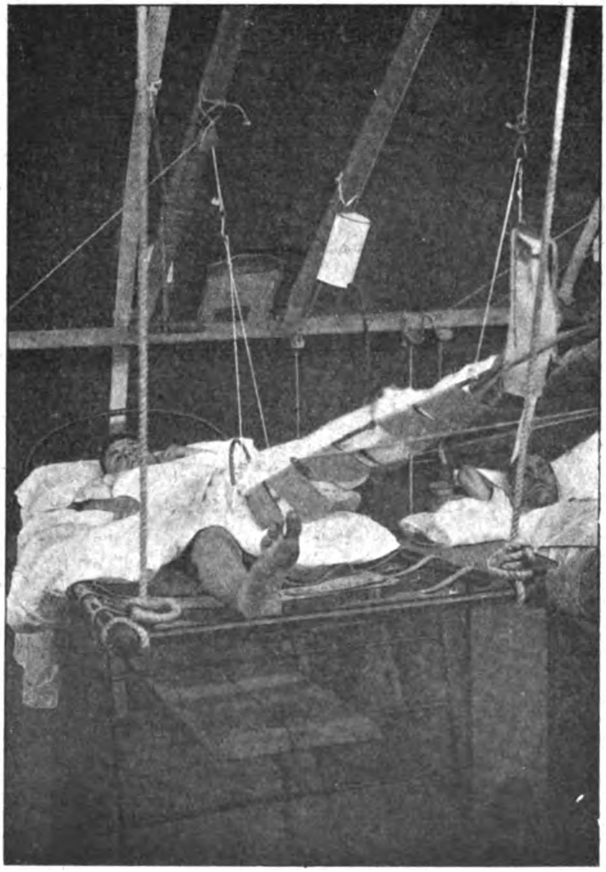


FIG. 4.—Showing section bed (devised by Major Pearson).

point of entry of the calliper. Calliper points should not be sharp, nor should they penetrate the bone to a greater depth than one-sixteenth of an inch. When embedded to this depth there is no possibility of the calliper slipping, as may occur when the calliper merely impinges on the bone surface.

The calliper may be left in situ for six to ten weeks, or in some cases even longer, provided that sepsis has been avoided. The limb below the

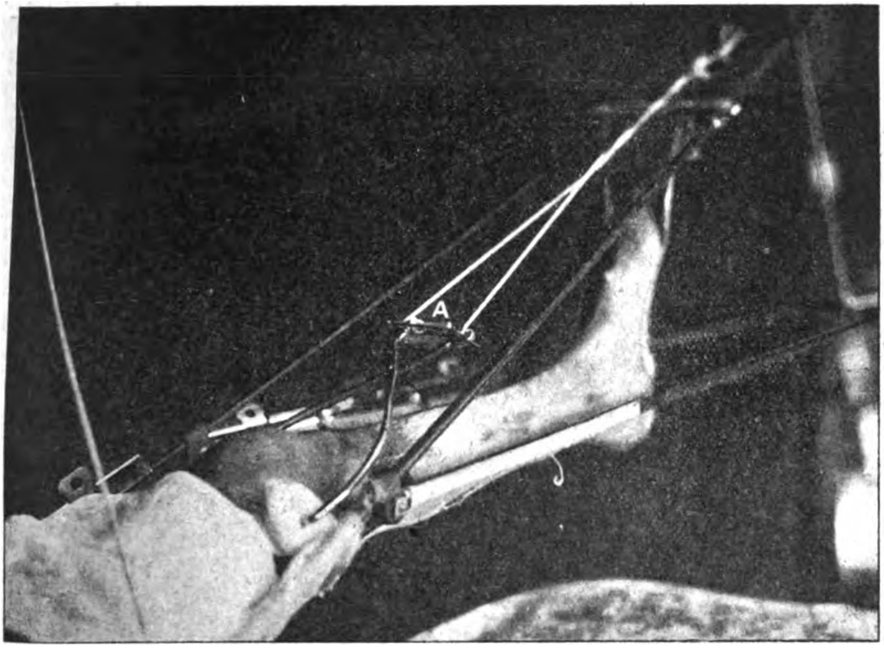


Fig. 5.—Showing callipers in condyles of femur, and (A) locking device.

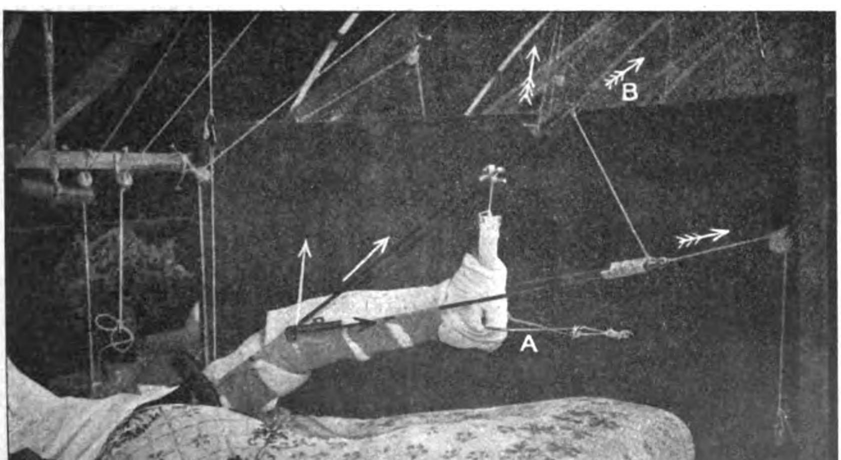


Fig. 6.—Showing (A) calliper in os calcis and (B) resultant force in suspension and extension.

knee rests in a flexion bar (fig. 5), the direction of extension being in the line of the main splint and therefore in the direct line of the fractured bone. The calliper is connected by stout cord to a powerful spring at the lower end of the main splint; hence the traction is unremitting. Counter-extension is obtained from the ischial tuberosity and pressure need at no

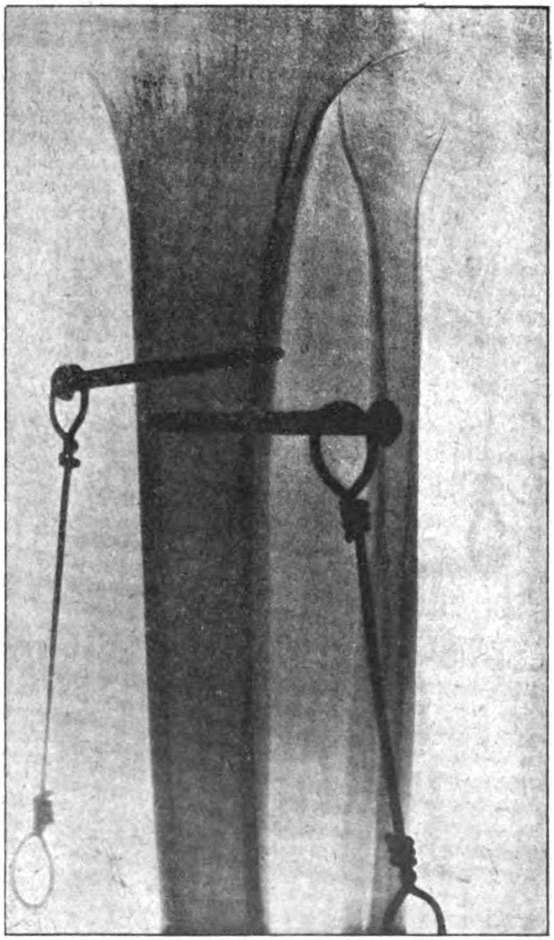


FIG. 7.—Showing extension pins in upper end of tibia.

time be exercised on the perinæum. Alignment having been obtained by these means in the operating theatre, it is maintained in the ward, and the pressure on the ischium relieved by the extension and suspension weights (fig. 6).

The system is practically painless and permits of passive movement of the knee-joint, thereby eliminating any tendency to ankylosis.

Though there is but little tendency for the calliper to penetrate the bone deeply, except in the presence of sepsis, it is well to use a locking device, as shown in fig. 5.

In the large number of cases treated by calliper extension, sepsis at the site of application of the instrument has been of rare occurrence, and was slight and easily controlled after removal of the calliper.

FIG. 8.—Showing position before wiring by encirclement.

In cases where callipers cannot be used from the condyles, and where glue extensions have been unsatisfactory, the callipers may be inserted into the os calcis at the level of a point one inch below the external malleolus (fig. 6).

Extension in the direct line of the femur is obtained, as shown in fig. 6, by the resultant force (B). (*The line of the resultant force is*

***obtained by the bisection of the angle formed by the junction of the two lines of force as shown in fig.* 6).**

Transfixion Pins.—We are opposed to the use of these when they are driven through the condyles of the femur, or indeed where any bone is completely perforated. They can be left in situ for six weeks at the utmost—an insufficient period in most compound fractures of the femur.

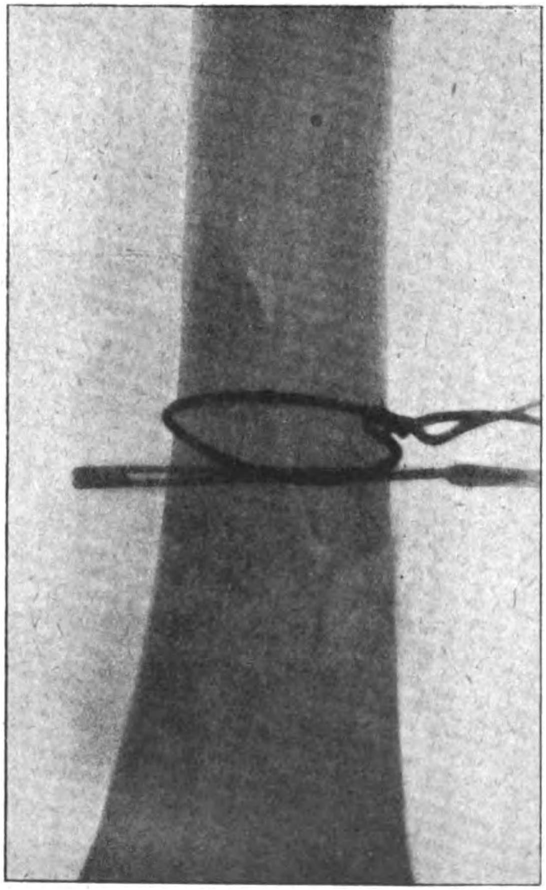


FIG. 8A.—Showing position after wiring.

Should sepsis occur during their use, persistent sinuses and chronic suppuration are by no means uncommon sequelæ. Should it not be possible to use callipers, we much prefer the transfixion pin passed through the soft tissues immediately above the os calcis, or to obtain extension by means of short pins screwed into the upper part of the tibia (fig. 7). These latter methods are entirely painless, and extension may be used from them for two to three months. Moreover the maintenance of asepsis is a comparatively simple matter.

Internal Fixation of Fragments.—A certain small percentage of cases are not amenable to the above modes of treatment. These cases include chest conditions where the patient must be got into a sitting position; and cases where there is much comminution with one or more large attached fragments between the ends of the bone (fig. 8). In all cases internal fixation is subsidiary to some form of extension and may take the form of wiring by encirclement, or, if the fracture is transverse, a Lane's plate may be wired to the opposing ends of the fragments (fig. 9). No drilling should ever be done through the fracture wound.

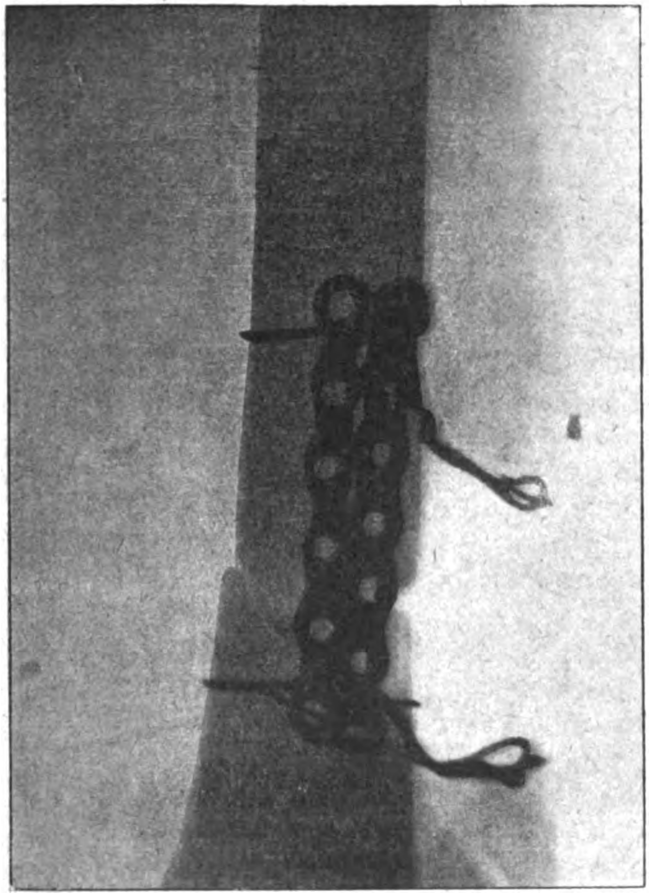


FIG. 9.—Showing Lane's plates used in transverse fracture.

Fixation by Beam Trammel.—A method of fixation which has been devised by us is shown in fig. 10. It is in the form of a beam trammel, and it also is employed in combination with extension. In its application it is essential to have aseptic areas over the great trochanter, and the outer side of the lower end of the femur, where the screws are applied.

In addition to being used as a method of fixation, it may, by first applying it to the lower fragment, be used as a lever for securing alignment, the upper end of the rod being clamped in position, when reduction has been obtained.

Complications.—(1) *Involvement of the knee-joint* is a serious complication, but does not necessarily negative a good orthopædic end-result. If the knee-joint is opened independently of the fracture wound it is treated by excision of wound, removal of foreign bodies, and suture, and in many of these cases an aseptic result has been attained. The joint may be opened by the fracture where there is longitudinal splitting of the lower fragment, or may be opened merely by the wound of the soft parts. The supra-patellar pouch is frequently involved in the latter way, and, when such is the case, an attempt should be made to shut off the knee-joint by means of excision and suture of the damaged synovia.

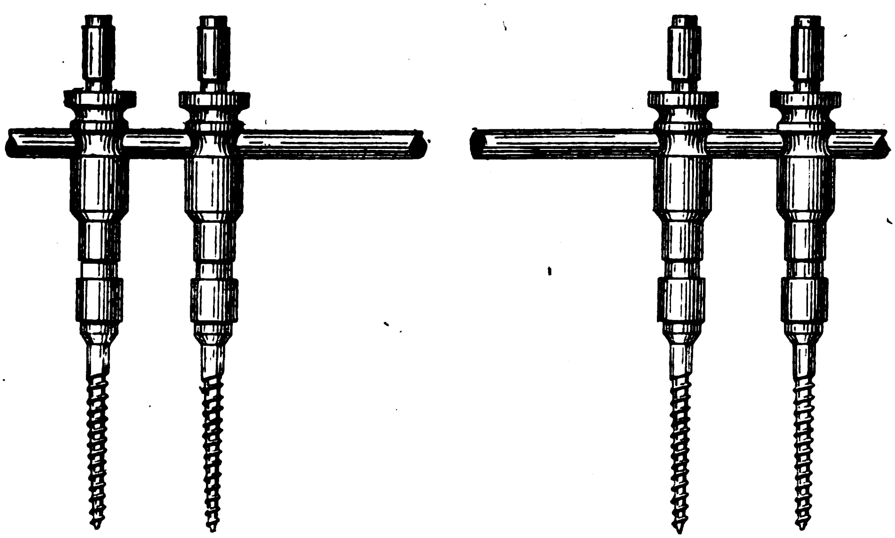


FIG. 10.—Showing beam trammel which is applied to outer side of great trochanter and outer side of lower end of femur.

When involved by the fracture, treatment will depend on the degree of severity of the infection. We have frequently found simple drainage by means of rubber drainage tubes sufficient, but the sepsis may be so severe as to call for a very extensive arthrotomy, or even amputation.

In all cases of involvement of the knee-joint, traction must be applied below it, otherwise ulceration of the cartilage and subsequent ankylosis follows.

(2) *The Sciatic Nerve* may be involved, and if this is accompanied by extensive muscular damage, the case is best treated by early amputation. The same remark applies where the femoral artery is severed, though this

is a less serious complication than severance of the nerve. Severance of the artery, with slight tissue damage, should be treated quite conservatively.

(3) *Gas Gangrene.*—The form of this infection which occurs most frequently at the Base, in gunshot fractures, as in other wounds with great muscular damage, is the septicæmic type. General symptoms, i.e., nausea and vomiting, with a small, much accelerated and indistinct pulse, precede the onset of local signs. Immediate amputation is the only hope in these cases, and if delayed until local signs are present, there is practically no chance for even that expedient to save the life of the patient. The local type is occasionally seen at the Base, but even in it we advocate immediate amputation. Conservative measures with gas gangrene have proved ineffectual in our hands.

(4) *Comminution.*—Where six inches or more of the shaft have been destroyed the limb should be amputated, since even if successful conservative measures are adopted the orthopœdic result is not worth the risks to which the patient must be exposed.

(5) *Spreading Sepsis.*—This may usually be checked by efficient and dependent drainage, but may assume the form of an acute cellulitis, which may be so severe as to leave no option but amputation. Abscess formation, due to spread of sepsis along the intermusculur planes, is of frequent occurrence, and is met by suitable incision and drainage.

(6) *Secondary hæmorrhage,* when inefficiently dealt with on making its appearance, is liable to recur, and may eventually necessitate amputation. The vessel should be ligated above and below the site of injury or ulceration, and the ligature material should be strong chromic catgut, since it has been shown that some antiseptics have a definite solvent action on silk thread.

Anæsthetics.—When amputation has been decided on, the anæsthetic of choice is either spinal anæsthesia or gas and oxygen. A remarkable feature presented by cases where these are used is the absence of shock throughout and after the operation. In spinal anæsthesia an initial fall of blood pressure is observed within, as a rule, the first ten minutes after administration. This is adequately counteracted by the injection of intravenous saline, or citrated blood. An additional advantage possessed by these anæsthetics is the complete absence of pulmonary sequelæ, even among patients in whom prolonged suppuration has produced an absence of resisistance.

Treatment of Wounds.—All cases of fractured femur should receive operative treatment at the earliest moment which the patient's condition and military exigencies allow. The importance of early excision cannot be overestimated. No factor so greatly contributes to the minimizing of sepsis, abolition of gas gangrene, and early callus formation as a thoroughly performed operation of this description. It should be done through a very large wound. We favour a partial esquillectomy performed at the same time, i.e., the removal of all fragments not having a firm periosteal attachment.

We have practised the complete sub-periosteal esquillectomy so strongly advocated by the French surgeons, and there are many theoretical advantages to recommend it, but there is no doubt that union is delayed by it, though sepsis appears to subside more rapidly after its performance. We have seen cases in which complete esquillectomy had been performed in which the wound was completely healed, but where only the slightest evidence of callus formation appeared under the X-ray. Eventually, however, good union is usually obtained, and that with healthy but not excessive callus formation.

Sub-periosteal esquillectomy is an operation demanding time and patience and should be performed through a large wound, preferably in the line of the external intermuscular septum, as from this wound—the external intermuscular septum being postero-external—dependent drainage may be obtained. This dependent drainage is to our minds of very great importance, the object being to permit of free escape of the discharges and necrotic tissues. Ordinarily, having established efficient drainage, we merely lightly pack the wounds with gauze, but in heavily infected cases continuous irrigation is of great value. We have been unable to demonstrate that antiseptics have much influence on controlling the sepsis, and are of opinion that irrigation may be effected as satisfactorily by sterile water or normal saline as by any other solution.

We prefer dependent drainage to the Carrell-Dakin system. In the later stages of wound treatment, when the sepsis has to some degree subsided, brilliant green is found to stimulate the process of repair.

Bacteriology of Wounds.—A bacteriological examination of the wounds is invariably made, and it has been found that, of the cases which present no clinical signs of gas gangrene, fifteen per cent give anaerobic growths, and the same percentage contains a streptococcus which is apparently a facultative anaerobe. These wounds are invariably troublesome, difficult to get into the healing state, and the sepsis is always more prolonged. Streptodiplococci and the coliform group are also frequently present, and whilst the latter cause a foul sepsis in the wound, they do not cause much general disturbance. Ordinary streptococci and micrococci are almost invariably present. *B. pyocyaneus* and a diphtheroid organism are occasionally found, but have little or no influence on the wound.

The flora of wounds changes as treatment progresses. The anaerobes disappear first, then the coliform organisms and the micrococci. The streptococcus is the last to be vanquished.

Orthopædic End-results.—We believe that the functional value of the limb is entirely dependent on the anatomical result obtained; hence the aim in every case is to reproduce as nearly as may be the original anatomical form.

Complete immobilization of the fragments is not incompatible with massage and passive movement of the joints of the affected limb. By means of the knee flexion-bar attachment, and the suspension above

referred to, the knee- and hip-joints may be so treated as to leave but slight limitation of movement in the majority of cases. It is important to preserve the anterior curve of the femur, and this may be done by the careful adjustment of the slings and extension weights controlled by frequent resort to the X-ray. The portable X-ray apparatus is of inestimable advantage.

The fragments should be carefully aligned as early as possible, since the regenerative function of bone begins a few hours after injury. It is our practice to extend the limb until $\frac{1}{4}$-inch lengthening has been secured. This allows for the slight subsequent contraction which very often follows after union has taken place. More lengthening it is not advisable to produce, though this could be very easily obtained, since the tension on the tissues, and more particularly on the damaged periosteum, may be harmful.

We are indebted to Colonel W. Thorburn, C.B., A.M.S., for many valuable suggestions; to Lieutenant-Colonel E. C. Hayes, for the facilities which have always been at our disposal and without whose encouragement and co-operation much of this work would have been impossible; and to Captain D. Scott Taylor for the skill and patience which he has expended in the X-ray work connected with these cases. Our thanks are also due to Captain W. Templeton for his invaluable help in the bacteriology of the wounds treated.

THE SYMPTOMS AND TREATMENT OF TRENCH FOOT.

By Captain T. HOWARD SOMERVELL.
Royal Army Medical Corps (T.F.).

(Received for publication October, 1917.)

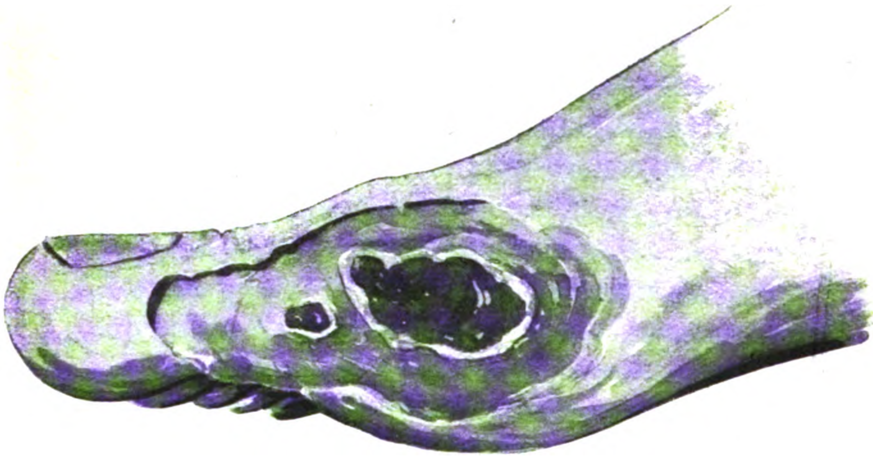
CONTENTS.

(1) Introduction.

Winter is coming on, and with it the mud which is now such a by-word in France and Flanders. And of all the diseases that the mud brings with it, the most important, perhaps, is trench foot. The wastage from this affection is very high at times, and, although prophylactic measures are beneficial, nothing has yet been found that is likely to prevent the disease from occurring again this winter. Trench foot will occur: and this fact must be faced—that in the previous winters of the war no standard treatment for trench foot has been adopted in the British Expeditionary Force.

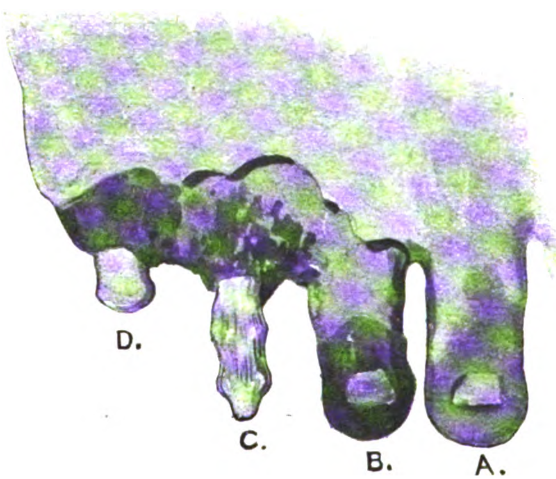
The camphor treatment of Médecin-Majors Raymond and Parisot met with great success in the French Army in the year 1916, and a D.M.S. in our Army instituted a systematic trial of this treatment in the medical units under his command last winter. Having treated, in collaboration with Captain Carswell Marshall, R.A.M.C.(T.F.), over 600 cases of trench feet at a casualty clearing station during this period, I am convinced that the camphor treatment, with slight modifications as described below, is the best treatment that has yet been found both for trench foot and for frostbite.

Many cases have been followed up by letter, and of these every single case which, on leaving the area, still required treatment, had the treatment changed. And, judging by the reports received, in every case the change was for the worse as far as the effect upon the feet and their rate of healing was concerned. I therefore venture to urge very strongly that this treatment be much more widely adopted, at least until such time as a better shall have been discovered.



I.

FIG. 1.—Late stage of severe trench foot. The blister has been cut away, and the slough is beginning to separate; on the proximal side of the sore, healing is commencing.



II.

FIG. 2.—Four stages in the detachment of a toe. A. The discoloured area shows a definite edge; no blister has formed as yet. B. The blister has formed and been excised; the tip of the toe is gangrenous; the rest is viable. C. Represents rather a more severe case in which the whole toe has become gangrenous and separated; the phalanges with their ligaments are left; the base of the toe is granulating healthily. D. The two distal phalanges have been removed; the toe is now ready for a resection of the proximal phalanx at the joint; healing of the skin at the edge of the granulation tissue has commenced.

To illustrate "The Symptoms and Treatment of Trench Foot," by Captain T. HOWARD SOMERVELL, R.A.M.C. (T.F.).

(2) Etiology.

Trench foot seems to bear such a well-defined syndrome of symptoms, resembling several other conditions, but not identical with any, that it may be considered as a clinical entity. Moreover, Médecin-Majors Raymond and Parisot, who have done much work on the subject in the French Army, have isolated a saprophytic organism, *Scopulariopsis koningii*, to which they attribute the condition. This organism was found in the mud of the trenches, and under the toe-nails of persons afflicted with trench feet, through which channel it usually enters the foot. It has been found by these observers to obey Koch's postulates, having been isolated from the bile of severe and jaundiced cases of trench foot. When injected into animals, it has produced the characteristic patches of local gangrene usually associated with trench foot.

Predisposing causes seem to be the following :—

(1) Soddenness of the feet, especially if brought about by wet mud over a period of several days.

(2) Cold.

(3) Prolonged stasis and inactivity.

(4) Tightly laced boots and puttees. The condition is always worse in cases who have had ankle boots, tightly laced, than in those who have worn gum boots. Moreover, the affection seldom extends above the ankle.

(5) Previous attacks of trench foot.

(6) General exposure. The hands, and, in kilted regiments, the penis, are sometimes attacked.

Considered entirely from the clinical standpoint, the condition seems to be an acute peripheral neuritis. This explanation would account for :—

(1) Vasomotor disturbance, coldness of the feet and the occurrence of local gangrene, which is always superficial, and somewhat resembles a trophic gangrene.

(2) Pain, sometimes intense, and sometimes very persistent.

(3) Anæsthesia, always present for a short time, and often followed by

(4) Hyperæsthesia of portions of the foot.

(5) Persistent neuritis of the foot and leg, often lasting for several weeks ; this occurs in about seven per cent of cases, to a greater or less extent.

(3) Symptoms.

Owing to the diversity of the symptoms in the different grades of cases, it is desirable to consider these in separate groups, both as regards their symptoms and the appropriate treatment.

Class A.—Slight Cases. Twenty-five per cent of all Cases.

These have *pain* in the feet and sometimes also in the calves. There is also more or less *anæsthesia*, especially of the dorsum of the foot ; there is little or *no swelling* of the feet. This degree of the malady is not serious, and passes off in a week or two.

Class B.—Moderate Cases. At least sixty per cent of all Cases.

Besides having *pain* and *anæsthesia* with or without *hyperæsthesia* of parts of the feet, these cases present a very characteristic *swelling* of the foot. Clinically it does not resemble an ordinary œdema, and often does not pit on pressure. Nor is it at this stage a blister, though it often exhibits some degree of fluctuation. It is, in fact, a condition intermediate between these two, and its semi-fluctuating, tense nature is very characteristic. After a few days (three to fourteen) the swelling subsides and the case becomes similar to those in Class A.

Class C.—Severe Cases. Nearly fifteen per cent of all Cases.

These cases, at first like those of Class B, with *pain, swelling* and *disturbance of sensation,* develop in addition a localized *discoloration* of the skin of the foot. This is most evident on the dorsum of the foot, and is of a dull copper-red colour at first, changing after a day or two to a more bluish shade. Part only of the discoloured area persists (generally the distal portion). This soon develops a definite edge, and over the discoloured area, extending roughly as far as the edge of it, the œdema resolves itself into one or more blisters of variable sizes. These are usually on the dorsum of the foot, and nearest to the two edges of the foot. The blisters of small size (as large as a sixpenny-piece or less) sometimes subside in a few days. The larger ones often spread and become confluent. When they burst or are cut off, an area of superficial necrosis, a little smaller than the area of the blister and of a greyish-purple colour, is revealed. In two or three days this necrosed portion of tissue begins to turn black and to separate slowly, commencing at the edges. Underneath these patches exists granulation tissue, and the necrotic portion rarely involves more than the dermis or subcutaneous tissues. The further appearances are described under the heading of Treatment. Healing takes place from the edge of the area where the blister has been, and is sometimes surprisingly rapid under appropriate treatment.

In less severe cases the swelling and discoloration both subside, and the case shows the characters of those in Class B.

In the more severe cases the discoloration involves the whole of one or more toes which become gangrenous. This gangrene seldom or never extends beyond the metatarso-phalangeal joint, except that which involves the skin only. The gangrenous portions separate as already described, and healing takes place by granulation.

Class D.—Grave Cases. Very rare, one Case in 200 to 500.

These patients, besides having the condition already described as regards their feet, show also serious constitutional symptoms, with high pyrexia (up to 105° F.), great prostration and later jaundice, nephritis, and œdema of the lung; sometimes the affection is fatal. I have seen but two such cases among over a thousand patients.

Complications.

Tetanus is fairly common, occurring in one to two per cent of uninoculated cases. Of one series of 250 such cases from the same battalion, four died of tetanus in the second or third week after exposure to trench feet. *Neuritis* persists for weeks in some cases, attacking the feet, legs, thighs and groins.

(4) PROPHYLAXIS.

Of prophylactic and preventive measures the writer has had no experience. It is advisable, however, for the sake of completeness, to mention here the main principles on which this is conducted.

(1) Drainage of the trenches.

(2) Disinfection of the foul or stagnant parts of the mud therein, as far as is possible.

(3) The cleansing of the feet of those who are about to enter the trenches. For this purpose they are well scrubbed with either :—

(*a*) Camphor soap made of—

Powdered camphor	4 oz.
Powdered borax	1 lb.
Soft potash soap	10 lb.

If this is not available, one may employ :—

(*b*) Ordinary soap used with warm water which has been made alkaline with carbonate of soda, about a handful of soda being used for a tub of water.

The toe-nails are cut short and thoroughly cleaned. The feet are dried and powdered with—

Talc powder	40 parts.
Powdered Camphor	1 part.

Clean, dry socks are put on. The boots are washed out with a strong solution of carbonate of soda. This should be done last thing before entering the trenches, and, if possible, twice a week at least when out of the line.

(5) TREATMENT.

A.—The Camphor Treatment.

On admission to a dressing station or casualty clearing station at least 500 units, and in severe cases 1,500 or even more units, of antitetanic serum should be given if not already done. In addition to this the feet should in all cases be washed thoroughly with the camphor soap described above, and the toe-nails should be cut and cleaned. Further treatment is different for the different degrees of severity of the complaint.

Class A.—After the feet have been washed and thoroughly dried, they should be wrapped in cotton-wool bound loosely round with a bandage. They should be sent to bed, or if beds are not available, to lie on stretchers, with plenty of blankets. The ward should be comfortably warmed. After

three or four days, if pain and tenderness have to a great extent disappeared, the patient may be allowed up, at first without boots, and afterwards with them. After a few days he may be given light duties in the hospital, and should not be sent back to full duty until his feet are quite fit. Two pairs of socks should be worn with the boots for several weeks after the patient has finished his treatment. Of over 100 cases of this degree of severity, sixty per cent were fit for return to duty in under a fortnight.

Class B.—After the cleansing described above in all cases in which a swelling of the feet is manifest, in place of the dry cotton-wool a wet camphor compress is applied. A piece of cotton-wool, or, better, Gamgee tissue, is dipped into the following lotion :—[1]

Camphor	1 part.
Sodii biboras	15 parts.
Water to	1,000 ,,

The wool is *gently* squeezed out and put on very fairly *wet*, being wrapped around the foot and covered with a piece of jaconet. A convenient size for the wool and jaconet is about eighteen inches square. Dry wool is put over the dressing and loosely bandaged with a roller or triangular bandage. The patient is sent to bed and kept as warm and comfortable as possible. No special diet is necessary. The compress should be renewed every day as long as the swelling persists. After the swelling has nearly subsided it may be removed and dry cotton-wool wrapped around instead. From this point onwards the treatment is as in Class A, save that convalescence is rather longer according to the severity of the case.

Of this class of case nearly 400 were treated at this casualty clearing station, and except in the more severe cases, the following was found to be the average routine :—

Wet compress on feet	3 to 8 days.
Dry wool on feet, patient in bed	4 ,, 7 ,,
Up in ward in soft shoes	3 ,, 4 ,,
,, ,, boots with two pairs of socks	3 ,,
Light ward duties—kitchen orderly, etc.	3 ,, 6 ,,
Outside duties, including carrying rations, stretcher-bearing, etc. ..	4 ,, 8 ,,
Total treatment before being fit for duty	20 to 36 days.

The periods for which the patients were allowed on their feet, together with the nature of their duties, should be well graduated. A few obstinate

[1] A convenient way of making this is as follows :—
A stock solution of four ounces of camphor to one pound of spirit. vini rect. is kept. Dissolve twelve ounces of sodii biboras in a quart or so of warm water. Add a gallon of cold water to this. Drop in three ounces of the camphor spirit solution. Fill up to five gallons, stirring all the time. with cold water. A five-gallon oil drum with the top cut off and used as a lid is a convenient receptacle for the lotion. As the liquid improves with keeping a good stock of it should be kept in wards and reception rooms or dressing rooms.

cases with pain, etc., require massage. As a routine treatment in this class of case it is useless.

Class C.—All cases of this severity should be sent to bed, if a bed is available, in a comfortable ward. They are treated as in Class B, until definite blisters or sores develop. When this occurs, blisters (except such of the very small ones as are not discoloured) should in every case be cut round their edges and taken away, together with all skin which is loose and easily detached. Over the raw surface thus exposed several layers of gauze are placed. On to them is dropped sufficient of the following solution thoroughly to moisten the gauze and the underlying parts :—

Camphor	½ oz.
Ether	1 lb.

The wet compress already described is placed over this, and the dressing completed as in the case of Class B. This is done every day as long as the surface remains raw.

In these cases two things may happen :—

(1) The raw surface remains pinkish-red and heals over from the edges. It must be kept clean at all costs. In the later stages the camphor treatment can be discontinued, and flavine solution or brilliant green ointment substituted. When the skin has healed over and is intact convalescent treatment is carried out as indicated above, but with longer periods to suit the gravity of the case.

(2) Local sloughs may form. Generally they are roundish in shape on the dorsum of the foot, but they sometimes involve one or more entire toes. The sloughs should not be pulled or torn off, but allowed to separate of themselves under the dressing (which should be changed once or twice daily). If there is much pus present a day's dressing with Dakin's solution in place of the camphor lotion, followed by reversion to the camphor treatment, will clean up the sore considerably. When quite loose and detachable the sloughs can be pulled off with forceps, a freely granulating surface is revealed, and healing takes place from the edges of the sore. In those cases in which the toes are involved, when the flesh of the toe is loose it should be pulled off, the bones of the toe being removed at the nearest joint to the granulating surface. This can be done without an anæsthetic and does not hurt the patient. Subsequently the bone which is projecting from the granulating surface should be removed at the joint which is embedded in tissue (in nearly every case this is the metatarso-phalangeal joint) under an anæsthetic. I have not seen a single case in which any amputation more extensive than this was necessary or desirable. Yet I know that such has been done. The foot in its early stages always looks worse than it ultimately turns out to be, and a foot that on the third or fourth day is blue and apparently dead from the tarso-metatarsal joints onwards, will very likely resolve itself into a case in which only a few toes or parts of toes are lost. Keep the feet clean and camphorated and the patient comfortable, and Nature will do the rest

with far better judgment than the finest surgeon. Skin-grafting will be necessary in very few cases; the skin heals over from the edge of the granulating surface at a remarkable rate, and any dressing other than camphor lotion or flavine solution will decrease this rate.

As the condition localizes itself to the distal end of the foot, which it usually does in the second week (in this class of case), the affected part of the foot only need be dressed with the lotion. Prolonged soddenness of the sole of the foot, though doing no great harm, will slightly increase the period of convalescence.

Class D.—These require the same treatment as Class C, with the addition of a large dose, 2,000 units or more, of antitetanic serum, and several subcutaneous injections *per diem* of camphorated oil (one to three cubic centimetres at a time). Otherwise the treatment is symptomatic.

Special Points to be Noted.

The outstanding fact to be borne in mind with regard to all the more severe forms of trench foot is the importance of *early* application of the camphor compress. Under its influence the foot "settles down" in a remarkable way during the first few days, and a foot which if kept dry would soon show multiple sores will, under the wet treatment, very likely recover completely, or with only one or two blisters. This statement is based on the observation of over eighty cases in which comparative treatment was tried as outlined below. Throughout the early stages in severe cases, an injection of 1,000 units antitetanic serum should be given every seven days. All severe cases of trench foot are particularly liable to tetanus, even if the skin remains unbroken, and even in a few inoculated cases tetanus has occurred.

Another important point is the advisability of keeping the patient in the *recumbent position.* He should not be allowed to sit with his feet hanging down, or to stand, until the swelling has completely subsided.

Warmth and comfort are also necessary. In February, 1917, the severe weather, resulting in the coldness both of the wards and of the patients' feet, retarded the progress of the disease in every stage, and even brought about one or two relapses. At this time the more severe cases, in an easily warmed bedded ward, did not suffer, comparatively, so much as the slighter cases in a tented ward which was impossible to heat thoroughly. Plenty of blankets, and hot-water bottles when needed, should be provided, and the food should be good and well cooked. The hot-water bottles may be put on the legs, but must not touch the feet. Patients exhibit much idiosyncrasy as regards their pain. Some have hot feet, while in other cases the feet are almost continuously cold; the cold compress relieves the pain of some, while apparently increasing it in other cases. Rubbing of the feet, which must be done gently, or the application of hot bottles, or the administration of aspirin or morphia may be necessary to relieve the pain.

B.—Alternative Treatments.

As a means of comparing various treatments, eighty patients were chosen in whom the condition seemed on admission to be equally developed in the two feet. In these cases one foot was treated by one method, while the other had a different treatment. Thus in comparing one treatment with another the personal equation was eliminated as far as possible, and it was ensured that the respective subjects of experiment had had a similar history as regards exposure to the causes of the disease. The following treatments were thus tested :—

(1) *Expectant Treatment.*—Only appears to be advisable in the slightest cases.

(2) *Massage.*—(*a*) with camphorated oil ; (*b*) with lin. terebinth ; (*c*) with powder only. This was found to be of very little use, and is certainly not worth the trouble involved ; it is useful only in the later stages of convalescence of fairly severe cases.

(3) *Hot and Cold Water Baths.*—The feet were kept for two minutes or so in buckets of hot and cold water alternately, for a period of half an hour or so. The object of this treatment was the stimulation of vasomotor action ; it is a good accessory to treatment for patients whose feet are persistently cold ; not recommended as a routine treatment.

(4) *Picric Acid.*—This was tried in blistered cases, on the analogy of the treatment for burns ; it is useful in maintaining the asepticity of the feet, but seems, as a treatment, to be very inferior to the camphor treatment.

(5) *Ambrene or No. 7 Paraffin.*—This was tried on several of my patients on their arrival in England ; the patients hated it, and said that it made their feet worse.

(6) *Fomentations (Hot Boric Lint).*—Apparently increases the tendency to blister, and encourages the formation of gangrenous patches.

(7) *Ointments.*—Useful only in cases with large superficial blisters which involve only the epidermis and are unaccompanied by local gangrene.

(8) *Camphorated Oil, applied as a Compress.*—Camphor seems to be almost a specific treatment for the infective agent of trench foot. This being so, it was thought that a dressing of camphorated oil, which contains twenty-five per cent of camphor, might be superior to the lotion, which contains but 0·1 per cent. This was found to be the case in some instances, especially in those cases who showed severe œdema of the feet. For such cases this treatment might be tried on a large scale ; it is rapidly applied and easy to work with, as no harm is done if a dressing be left on for two or three days. But on the whole, as a general treatment for all cases, the balance lies with the camphor lotion treatment, as outlined above.

(9) *Dakin's Solution (for the raw surfaces in bad cases).*—This is useful, as already mentioned, if the necrotic parts have a foul smell, or if much pus is present. It is a useful disinfectant, but does not stimulate the healing processes in the same way as does camphor. The foot does not seem to

"tire" of the camphor dressing, in the same way as that in which wounds sometimes get indolent under Dakin's solution and similar liquids; and only in very rare instances is there any indication for the changing of the treatment. Camphor, in fact, seems to have a definitely proliferative action on the cells of the skin, similar to that exerted by allantoin and flavine, which, indeed, might be tried in the later stages with advantage. In the carrying out of these treatments much valuable advice, and every possible facility, were given me by my Commanding Officer, Lieutenant-Colonel G. C. E. Simpson, R.A.M.C.(T.F.).

(6) Sequelæ.

The majority of patients heal according to the descriptions given above, but in perhaps ten per cent of cases some degree of trouble persists. The commonest sequel, as mentioned already, is neuritis, but this seldom lasts for more than a few weeks. Cold weather has a very deleterious effect on the convalescing feet. In many patients convalescence was much retarded during the severe frosty weather. The feet became painful and swollen in about two per cent of cases, while the patients were still on light duty in the hospital. In one case in which the foot had healed, patches of necrosis appeared, due apparently to the effect of the severe weather.

Recurrence of the disease is more likely to occur on re-exposure to the requisite conditions, in patients who have recently suffered from the complaint. Besides this, an actual relapse, as distinct from a recurrence, occurs sometimes, though in all the cases observed only three relapses, within two months of entry into the hospital, were observed. Relapse after adequate treatment and a carefully graduated convalescence is a rare event.

The subject of tetanus has already been mentioned.

(7) The Retention and Evacuation of Cases.

In January, 1917, of all slight cases treated in this casualty clearing station, over sixty per cent were returned to duty within three weeks, many of these going back after eleven and twelve days. Of the more severe cases, twenty to thirty per cent were at duty within a month, in a period of very severe weather.

It would seem advisable, therefore, to retain the slighter cases in corps or army areas, and, after suitable treatment with a graduated convalescence, to return them to duty.

As regards the more severe cases, experience has shown that the early application of the camphor dressing and the placing of the patient in a recumbent position are the two most important points in treatment. Thus these cases should be evacuated to the base as lying cases, unless there is any definite contra-indication to so doing. In cases of considerable severity evacuation should not take place until the patient shows signs of definite

improvement, as the disturbances and discomforts incidental to an evacuation in cold weather may be prejudicial to the case.

(8) Frostbite.

Mention should be made of this affection, which bears great resemblance to trench foot. A good many cases were observed last winter.

The condition is generally similar to a trench foot of fair severity (Class C), with the exception that the whole process in the early stages of the disease is much quickened. Sometimes the line of demarcation of the discoloured area on the foot or hand is well established a few hours after exposure to the cold has taken place. The foot is very seldom swollen to any great extent, but the subsequent history of the case is similar to that of trench foot.

The blisters, areas of necrosis, separation of the sloughs, and healing process, resemble those of trench foot. Frostbite is rarely seen without some superficial necrosis at least.

The similarity between the symptoms in the two diseases suggested a trial of the camphor treatment for frostbite. It was found to be very good for hands and feet both if carried out exactly on the lines indicated above.

Several other treatments were tried, but none were found to be so useful as the camphor treatment. Massage, however, is useful—in fact, almost necessary—in the initial stages, i.e., when the feet have failed to recover their circulation. In later stages massage is injurious. If circulation is difficult to re-establish, the hands or feet may be put into cold water, the temperature of which is slowly raised by the addition of hot water. Some sodium carbonate should be dissolved in the water to render it alkaline.

(9) Summary and Conclusions.

The camphor treatment, as outlined above, appears to be at least as good as any other treatment for trench feet. Its adoption on such a large scale by the French Army Medical Service, as well as its success when tested in the Fourth Army of the B.E.F., justify this claim.

Moreover, it is very simple: the stock solutions for its employment are easily made, and as easily dealt with in applying the treatment. It requires no cumbersome apparatus, and no special drugs except camphor and borax, both of which can be obtained with comparative ease in the quantities required.

Owing to the straightforward nature of the dressing, a large number of cases can be dealt with in a fairly short time.

THE ANTI-SCORBUTIC PROPERTIES OF CONCENTRATED FRUIT JUICES.

By ARTHUR HARDEN AND ROBERT ROBISON.
(*From the Biochemical Department, Lister Institute.*)

PART I.

Holst and Frohlich (1912, 1913) have shown that the anti-scorbutic principle, present in so great a degree in fresh fruits and vegetables, is to a large extent lost when these are dried or subjected to a high temperature. This fact, which they attributed to the decomposition of the accessory factor, has been confirmed by Harriette Chick and E. Margaret Hume (1917) and others.

The possibility that this loss is partly or wholly caused by the volatilization of the accessory substance does not, however, appear to be excluded by the experiments of these workers, and in view of our complete ignorance as to the chemical nature of the active compound, it seemed of some interest to investigate this point.

Maze (1899) observed that aldehyde is present in fresh peas, and it was to be expected that this compound would be present also in dried peas after germination (*v.* Chick and Hume, 1917). During maceration of a large quantity of germinated "clipper" peas, the odour of acetaldehyde was distinctly perceived, and on distillation the first small fraction gave positive reactions with Schiff's reagent and with diethylamine and sodium nitroprusside ("Rimini's" test). By treatment with p-nitro phenyl hydrazine a mixture of hydrazones was obtained, from which acetone p-nitro phenyl hydrazone was separated in a pure condition (m. pt. 148° C.). The more soluble substance melted about 118° C., and appeared to be acetaldehyde p-nitro phenyl hydrazone, but owing to the small amount of material attempts to purify it were not entirely successful.

No. of animal	Diet	Initial weight of animal (grm.)	Condition of animal during course of experiment	Length of experiment (days)	Final weight of animal (grm.)	Result
101 (Control)	Mixed diet; 5 mg. acetaldehyde daily	273	Weight increased steadily and animal in good health	31	410	No toxic effects from acetaldehyde
102	Oats, bran, water; 5 mg acetaldehyde daily	411	Weight maintained during 19 days, then fell steadily	31	254	Killed on 31st day. Severe scurvy symptoms
103	Oats, bran, water; 2 mg. acetaldehyde daily	332	Weight maintained during 19 days, then fell steadily	30	216	Killed on 30th day. Severe scurvy symptoms
104	Oats, bran, water; 1 mg. acetaldehyde daily	264	Weight maintained during 21 days, then fell steadily	30	156	Death from scurvy on 30th day

Aldehyde was also found in the distillate from germinated peas after these had been steamed for one hour, and in many other anti-scorbutic food-stuffs. A series of tests on guinea-pigs showed, as was expected, that acetaldehyde in quantities such as are found in fruit juices, etc., possesses no anti-scorbutic properties.

A series of more general experiments was carried out with orange juice, separated at a low temperature and as completely as possible into its volatile and non-volatile constituents. In order to effect this separation without losing any portion of the volatile constituents of the juice the following method was employed. The side tube of a small distillation flask was connected by means of a rubber cork with a filter flask to serve as a receiver, and a tap funnel was similarly fitted into the neck of the distillation flask. The whole apparatus was evacuated and was then sealed up by means of a screw clip. The freshly expressed orange juice (forty-five cubic centimetres) was then cautiously introduced through the tap funnel, care being taken that no air should enter at the same time. The distillation flask was next immersed in a bath of water kept at a temperature of 40° C., whilst the receiver was immersed in ice water. With well-fitting connexions the vacuum was sufficiently maintained and the distillation was usually completed in about an hour.

The distillate was divided into three equal portions, each of which served as the daily dose for one guinea-pig. The almost solid residue, dissolved in thirty cubic centimetres of distilled water, was also divided into three equal portions, each being the daily dose of one guinea-pig. Each of the first group of three guinea-pigs thus received the volatile constituents of fifteen cubic centimetres of fresh orange juice, while each of the second group received the non-volatile constituents of a similar quantity of juice daily. In addition, each animal received a diet of oats, bran and water. The results of these experiments are shown in the table on next page.

The behaviour of the three animals which received the volatile constituents of orange juice was thus in no way different from the normal behaviour of guinea-pigs fed on a diet of oats, bran and water alone; whereas the three animals which received the non-volatile constituents were maintained in good health, and gained from ten per cent to eighteen per cent of their initial body weight during a period of two months. It must be concluded, therefore, that the anti-scorbutic principle in orange juice is non-volatile under the conditions of the experiment, and the loss of potency which takes place when the juice is heated must be attributed to decomposition of the active compound.

The pronounced anti-scorbutic value of the residue obtained from orange juice in this manner led us to prepare a larger quantity, in order to determine whether the active principle would be destroyed on keeping as rapidly as has been shown to occur in other dried fruits and vegetables.

No. of animal	Diet	Initial weight of animal (grm.)	Condition of animal during course of experiment	Length of experiment (days)	Final weight of animal (grm.)	Result
105	Oats, bran, water *ad lib.* + volatile constituents of 15 c.c. orange juice	376	Weight maintained until 18th day (395 grm.), then fell rapidly	27	280	Killed on 27th day. Severe scurvy symptoms
106	,, ,, ,,	389	Weight maintained until 12th day (384 grm.), then fell rapidly	29	210	Death from scurvy on the 29th day
107	,, ,, ,,	328	Weight maintained until 20th day (325 grm.), then fell rapidly	31	195	Killed on 31st day. Severe scurvy symptoms
108	Oats, bran, water *ad lib.* + non-volatile constituents of 15 c.c. orange juice	274	Weight maintained throughout experiment (maximum weight, 345 grm.)	61	321	Animal in good health. Killed on 61st day. No signs of scurvy
109	,, ,, ,,	298	Weight maintained throughout experiment (maximum weight, 351 grm.). Autoclaved milk given from 48th day	61	351	Animal in good health. Killed on 61st day. No signs of scurvy
110	,, ,, ,,	335	Weight maintained throughout experiment (maximum weight, 379 grm.). Autoclaved milk given from 37th day	56	370	Animal in good health. Killed on 56th day. No signs of scurvy

A considerable quantity of freshly expressed orange juice was accordingly concentrated in quantities of 200 cubic centimetres at 40° C. under reduced pressure. The receiver was immersed in ice, and the juice was evaporated to a thick syrup in about two hours; it was then transferred to a basin and worked up with a spatula so as to bring about the occlusion of numerous small bubbles of air. On putting the basin in a desiccator, and evacuating the latter, the expansion of these air bubbles caused the syrup to rise in a golden foam by which the removal of the remaining moisture was greatly accelerated. In this way a crisp, hygroscopic solid was obtained, which was very pleasant to the taste.

In a preliminary test a guinea-pig, 442 grammes in weight, was fed on oats, bran, and autoclaved milk, with the addition of one gramme of the dried juice (equal to nine cubic centimetres fresh orange juice) daily during forty days; the amount of dried juice was then reduced to 0·5 gramme (equivalent to about 4·5 cubic centimetres fresh juice) daily, and the experiment was continued for a further twenty-eight days when the animal was killed. During the whole period of sixty-eight days the weight of the animal was maintained (final weight 463 grammes), and its health was good. The post-mortem examination revealed none of the usual signs of

scurvy. The juice was prepared in June, 1917, and was stored in a desiccator over sulphuric acid, at room temperature. No signs of decomposition have been observed.

Further tests were carried out during the period October, 1917, to January, 1918, with material that was therefore four to seven months old. The results of these experiments, which are given below, show that the anti-scorbutic value of the dried juice had not diminished to any considerable extent on keeping, and that a daily ration of 0·5 gramme (equivalent to about 4·5 cubic centimetres of fresh orange juice) was sufficient to protect a guinea-pig of 400 grammes weight from scurvy.

No. of animal	Diet	Initial weight of animal (grm.)	Condition of animal during course of experiment	Length of experiment (days)	Final weight of animal (grm.)	Result
121	Oats, bran *ad lib.*; autoclaved milk (60 c.c.). From the 13th day 0·5 grm. dried orange juice given daily	340	Weight increased steadily until the 32nd day and thereafter remained fairly constant (maximum weight 475 grm.)	90	460	Animal in good health; killed on 90th day; no signs of scurvy
122	Oats, bran *ad lib.* From the 13th day 0·5 grm. dried orange juice daily	322	Weight increased steadily throughout experiment	84	549	Animal in good health; no signs of scurvy
	From the 84th day oats, bran and autoclaved milk only		Weight maintained until the 94th day (540 grm.) and then fell rapidly	104	402	Death from scurvy on 104th day—i.e., on the 21st day after the last dose of dried orange juice was given

Curative experiments on guinea-pigs were also carried out during October to December, 1917, with the dried juice prepared in the previous June. The results are shown in the table on next page.

In the case of guinea-pig No. 114, a microscopical examination of the ribs was very kindly carried out by Miss Tozer, to whom we are indebted for the following report:—

"Microscopical preparations show considerable disorganization of the costachondral junctions, the rows of cartilage cells being much reduced in length. The majority of the trabeculæ have at some early period been broken off and ossification has taken place at the broken edge, forming an uneven bony line across the junction. This can be taken as evidence only that the animal had at some period suffered from severe scurvy."

It is intended to carry out further tests with the dried orange juice after this has been kept at room temperature for twelve months.

No.	Day of experiment	Diet	Weight of animal (grms.)	Average daily consumption of oats and bran (grms.)	Condition of animal
112	1	Oats, bran, autoclaved milk	359	30	
	21		371	27	
	22		355	9	Scurvy symptoms observed
	23	+ 1 grm. dried orange juice	347	8	
	24	Daily dose of dried juice increased to 1·5 grm.	332	8	
	28		287	14	
	29		295	27	Condition improving
	34		308	39	
	40		299	30	
	48		265	30	General condition not so good
	52		207		Death occurred. The post-mortem examination revealed no severe hæmorrhages, nor were the bones markedly brittle. The costachondral junctions were enlarged ; the teeth were somewhat brittle but firm. The animal had evidently suffered from scurvy at some period, but this was probably not the immediate cause of death
113	1	Oats, bran, autoclaved milk	315	32	
	17		310	34	
	19		305	34	Scurvy symptoms observed
	21	+0·5 grm. dried orange juice daily	277	30	
	24		250	2	Death from scurvy
114	1	Oats, bran, water	922	30	
	14	Oats, bran, autoclaved milk	842	35	
	20		834	30	
	23	+1·5 grm. dried orange juice	765	16	Scurvy symptoms observed
	24	Daily dose of dried juice increased to 2·5 grm.	753	12	
	25		740	21	
	31	Daily dose of dried juice decreased to 1·5 grm.	785	45	Condition much improved
	40		849	45	
	58	Daily dose decreased to 0·5 grm.	862	45	Good health. No scurvy symptoms
	83		840	45	Good health. Animal killed. No signs of scurvy

Summary.

(1) The anti-scorbutic principle in orange juice is not volatilized when the juice is distilled at 40° C. under reduced pressure.

(2) By evaporation of orange juice at 40° C. under reduced pressure it is possible to obtain a solid residue, which possesses the anti-scorbutic value of the fresh juice in a very high degree. This value is not appreciably diminished when the substance is kept in a dry atmosphere at room temperature during six months.

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PART II.

By ROBERT ROBISON.

(From the Hygiene Department, Royal Army Medical College.)

THE promising results obtained in the experiments with dried orange juice (Harden and Robison) led to an extension of the investigation to other fruit juices in the hope that their concentration and preservation without serious loss of their anti-scorbutic value might be found practicable.

CONCENTRATED LIME JUICE.

Through the courtesy of the Kestner Evaporator and Engineering Co., Ltd., a quantity of crude lime juice was concentrated in the "Kestner evaporator" within a few days of the arrival of the juice in England.

In this process the duration of heating is less than one minute for any portion of the juice, so that no considerable loss of the anti-scorbutic principle might be expected to occur. The concentration was carried out under reduced pressure and the resulting syrup which contained seventy-five per cent total solids was mixed with twice its weight of sugar, so that one gramme of the semi-solid mixture was equivalent to 2·5 cubic centimetres to three cubic centimetres of the original lime juice.

A series of tests on guinea-pigs was carried out, but the animals did not willingly take the sour juice even when mixed with autoclaved milk, and in some cases resisted so strongly as to make the experiment of little value.

There was also at the time great difficulty in obtaining a sufficient number of guinea-pigs, so that the possibility of individual idiosyncrasies must be taken into account in the interpretation of the results. (See table on next page.)

If we ignore the unsatisfactory experiments with the unsweetened lime juice these results show that a daily dose of one gramme of concentrated lime juice containing sixty-six per cent of added sugar (equivalent to 2·5 to 3·0 cubic centimetres of the original juice) is barely sufficient to protect a guinea-pig of 300 to 400 grammes body weight from scurvy.

A daily dose of 2 grammes (equivalent to 5 to 6 cubic centimetres of the original juice) would appear sufficient to afford protection, but this cannot be taken as conclusively proved.

The doses of unsweetened juice given to guinea-pigs Nos. 130, 131 were equivalent to 2·5 to 3·0 cubic centimetres and 5 to 6 cubic centimetres respectively, but it is doubtful if the animals ever swallowed the full amount.

A curative experiment was made, but the result was unsatisfactory owing to the large dose of the very acid juice necessarily given.

Guinea-pig No. 132, initial weight 381 grammes, was given a diet of oats, bran and autoclaved milk. Its weight was maintained until the

twenty-third day and then fell rapidly. From the twenty-fifth day five grammes of the concentrated juice containing sugar was given daily. There was some improvement in the animal's appetite, but the weight continued to fall slowly. Death occurred on the thirty-second day and signs of scurvy were found, but were not pronounced.

These results in any case prove that the loss of anti-scorbutic value which occurs when the lime juice is concentrated by this process is not very great.

No. of animal	Diet	Initial weight of animal (grm.)	Condition of animal during course of experiment	Length of experiment (days)	Final weight of animal (grm.)	Result
123	Oats, bran, autoclaved milk. From the 14th day 1 grm. concentrated lime juice containing 66 per cent added sugar given daily	332	Weight rose slowly until the 30th day (386 grm.), remained stationary until the 37th day and then very slowly fell. Appetite remained normal throughout experiment	88	279	Slight tenderness of the joints observed on the 18th day. Symptoms became more pronounced about the 38th day. Death from scurvy on 88th day.
124	Oats, bran, autoclaved milk. From the 14th day 2 grm., concentrated lime juice containing 66 per cent added sugar given daily	318	Weight rose slowly throughout the experiment	41	403	Death by accident on 41st day. No signs of scurvy.
127	Oats, bran, autoclaved milk (control)	317	Weight rose slowly until the 17th day (377 grm.), then fell rapidly	25	249	Scurvy symptoms observed on the 18th day. Death from scurvy on 25th day.
130	Oats, bran, autoclaved milk. From the 14th day 0·33 grm. concentrated lime juice without added sugar. From the 36th day dose increased to 1·5 grm. daily	502	Weight maintained until the 16th day, then fell steadily	41	314	Animal did not take lime juice satisfactorily. Death from scurvy on 41st day
131	Oats, bran, autoclaved milk. From the 14th day 0·66 grm. concentrated lime juice without added sugar. From the 36th day dose increased to 1·5 grm. daily	398	Weight rose slowly until the 20th day (445 grm.), remained stationary until the 33rd day and then fell slowly	49	398	Scurvy symptoms observed on the 32nd day. Animal strongly resisted administration of lime juice and on 49th day it choked and thereafter refused all food. Death occurred on 55th day from inanition (262 grm.), but scurvy signs were found

Concentrated Apple Juice.

The prolonged heating to which fruit juices are subjected in the usual processes for the manufacture of jams and jellies renders it unlikely that these would ever possess any considerable anti-scorbutic value. It appeared of importance therefore to examine any products manufactured by other processes in which such prolonged heating was not employed.

No. of animal	Diet	Initial weight of animal (grm.)	Condition of animal during course of experiment	Length of experiment (days)	Final weight of animal (grm.)	Result
125	Oats, bran, autoclaved milk. From the 14th day 1 grm. apple jelly given daily	329	Weight rose steadily until the 22nd day (406 grm.), remained stationary until the 65th day, and then fell very slowly	93	324	Scurvy symptoms observed on the 62nd day. Animal killed on the 93rd day. Scurvy symptoms not severe
126	Oats, bran, autoclaved milk. From the 14th day 4 grm. apple jelly given daily	391	Weight rose slowly until the 81st day (548 grm.), then remained fairly constant	100	537	Good health. No signs of scurvy
128	Oats, bran, autoclaved milk. From the 14th day 0·5 grm. apple jelly given daily	411	Weight rose slowly until the 20th day (451 grm.), remained stationary for a few days and then fell rapidly until the 36th day (352 grm.). Consumption of oats and bran fell to less than 10 grm. daily	69	287	Death occurred on the 69th day. The post-mortem examination showed the animal to have been suffering from severe scurvy
	From the 36th day 2 grm. apple jelly given daily		From the 37th day the appetite rapidly improved and the weight was maintained for some days but again fell steadily though the appetite remained normal			
129	Oats, bran, autoclaved milk. From the 14th day 0·5 grm. apple jelly given daily	342	Weight rose slowly until the 21st day (385 grm.), then fell rapidly	27	324	Scurvy symptoms observed on the 21st day. Killed on the 27th day. Scurvy very severe
133	Oats, bran, autoclaved milk (control)	519	Weight maintained until the 18th day (513 grm.), then fell rapidly	26	351	Death from scurvy on the 26th day

A sample of concentrated apple juice, kindly supplied by the Kestner Evaporator Co., Ltd., was therefore tested for anti-scorbutic properties. It was freshly prepared from the juice of cider apples by concentration in the "Kestner evaporator" to about one-sixth of its original volume. In this process the duration of heating is less than one minute and the maximum temperature is about 102° C. The sample examined was a soft

jelly containing eighty-three per cent of total solids. It was somewhat tart to the taste, but was very palatable. One portion of the jelly was treated with 0·01 per cent of sulphur dioxide, while the other was untreated. Both have been kept at room temperature during three months, but in neither have any signs of fermentation been so far observed.

The "Apple Orchard Jelly" made for the Food Production Department is prepared in a similar manner, but is somewhat less concentrated and contains added sugar.

The results of animal experiments are given in the preceding table.

These results show that a daily dose of four grammes of the concentrated apple juice (equivalent to twenty-four grammes of the fresh juice) is sufficient to protect a guinea-pig of 400 grammes weight from scurvy. A daily dose of one gramme (equivalent to six grammes of the fresh juice) is barely sufficient to afford complete protection, while 0·5 gramme only delays the onset of scurvy for a short time.

It would appear, therefore, that apple jelly prepared in this way possesses very valuable anti-scorbutic properties though not in the same high degree as the dried orange juice.

The general use of fruit jellies prepared by this or other similar processes in place of ordinary jam would doubtless be of considerable advantage wherever there is reason to suspect that the diet is deficient in the anti-scorbutic principle.

Clinical and other Notes.

A SIMPLE LOCALIZER FOR FOREIGN BODIES.

(May be known as "A.M.D. Grid Localizer.")

By WAR OFFICE X-RAY COMMITTEE.

Many problems in surgery have been brought into prominence during the War, and towards their solution valuable progress has been made. Amongst these problems, that of the localization of foreign bodies has attracted much attention, and much ingenuity has been displayed in its solution.

In the details of the methods employed there is a constantly recurring conflict between precision and simplicity. This conflict is certainly not essential, but it is only to be avoided by a compromise which takes into account the practical circumstances, not only of the localization, but of the subsequent surgical operation to which the localization must necessarily be subservient. This is no apology for any method of localization which of itself introduces elements of uncertainty, and amongst such elements must be reckoned the personal factor involved in judgment and comparison of variable data such as observation of relative shadow movements.

Preference should be given to methods employing data capable of being definitely registered and measured, and the registration of those data should be as direct and simple as possible. When one bears in mind the relative inaccuracy involved in the essential conditions of operating on a wounded part, the futility of over-elaborate steps in the process of localization is readily appreciated. Accuracy is essential, but the means used to arrive at that accuracy must be as simple as possible. On the one hand we have processes such as parallax methods which are extremely simple, but of which the accuracy entirely depends upon the observation of data capable of personal variation; on the other hand we have elaborate apparatus, such as the many ingenious devices described by our French colleagues, of which the accuracy is counterbalanced by the intricacy of their use.

The value of any method of localization may be estimated in relation to two factors, namely, the preliminary conditions requiring to be known or fixed, and the subsequent calculation necessary to convert the observed data into the required fact of position or depth of foreign body. Simplicity and accuracy are required in both. Under present conditions, when so much X-ray work is necessarily done by partly trained and inexperienced workers, there is a special need of simplicity. The attainment of this involves both the number and nature of the observations requiring to be made. Apart from methods demanding the use of sensitive plates, simplicity and accuracy have so far been most efficiently combined in the triangulation methods recommended for use in the British Army. In evaluation of this method, the process may be considered in its two steps as defined above, namely, the preliminary factors to be fixed or known, and the subsequent calculation to be made. The preliminary factors are two in number,

tube distance and tube shift. If they can be fixed as standard for a series of operations they involve no great difficulty, and the subsequent calculation after measurement of the shadow shift is simple. If, however, these factors are variable and require repeated measurement, possible fallacies are introduced, and the subsequent calculation, though simple enough, is viewed with concern by many workers.

Another method, of which the principle has been in limited use in more or less experimental forms, has been for some time under consideration by the War Office X-ray Committee, and a design has now been produced which promises to satisfy the two criteria of accuracy and simplicity to a greater degree than in any screen localizing method hitherto in use. Methods based on a similar principle have been described by Roussel and by Strohl, as mentioned in "Localization and Extraction of Projectiles," by Ombrédanne and Ledoux-Lebard.

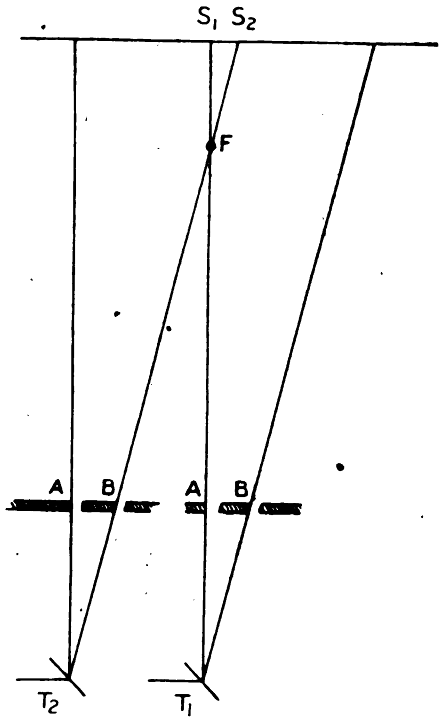


FIG. 1.

The chief point in common is that only one preliminary factor is concerned; that is settled by the dimensions of the particular tube box to be used and is fixed for all time for that tube box under any circumstances. The tube distance from the screen is immaterial so far as estimation of depth is concerned and need not be measured in any way. The tube shift need not be measured but is controlled solely by observation of the shadow of the foreign body, and the setting of the latter on the screen to two shadow-points cast by opaque indicators fixed across the opening of the tube box. After skin marking (which is done in the usual

way through the screen or screen carrier, or by a ring localizer, as preferred by the individual operator) only one observation or measurement is called for, namely, the measurement of the shadow shift between two definite positions—a process already familiar to all X-ray workers; and the after-calculation is simply to multiply that by the factor two or four. The simplicity of the method is obvious from the above remarks; its accuracy is mathematical, and the possibility of error is reduced to a minimum. The latter point will be evident when it is recalled that on the ordinary conversion scale for triangulation methods—say for tube distance fifty centimetres and tube shift six centimetres—one millimetre of shadow shift corresponds roughly to one centimetre of depth for depths less than six centimetres. It will thus be seen that any error in setting the indicators to the foreign body shadow on the screen is multiplied tenfold in the result. With the method under review, any error of inaccuracy of this kind is at most multiplied by four, usually by two; whilst the setting of the indicators is quite as simple—probably more so—than in earlier methods. The principle of the method is represented in the annexed figure (fig. 1).

Principle of Method.—In fig. 1, let T_1 and T_2 represent two successive positions of the target of an X-ray tube, A and B openings at a fixed distance in an opaque plate interposed between tube and screen and fixed to move with the tube box, F a foreign body.

S_1 and S_2 will represent on the fluorescent screen two successive shadows cast by F while exposed to rays passing through A and B respectively, the X-ray tube having been moved in the interval from T_1 to T_2, so as to secure these shadows.

It can readily be seen that the two triangles F S_1 S_2 and T A B are similar in all respects, and that the ratio of F S_1 to S_1 S_2 must be the same as the ratio of T A to A B.

If T A be a fixed distance and A B be made a definite multiple of that distance, then by measurement of the shadow shift S_1 S_2 on the screen the depth S_1 F of the foreign body F may readily be calculated, for it will be the same multiple of S_1 S_2 that T A is of A B. Example: If A B be made one quarter of T A then $S_1 F = S_1 S_2 \times 4$.

This relation may be seen more plainly from the diagram in fig. 2. There x represents the shadow shift measured on the screen, and y represents the depth of the foreign body below the screen, and $\frac{x}{y} = \frac{a}{b} = \frac{i}{m}$; therefore $y = x \times m$, i.e., the depth of the foreign body from the screen is found by measuring the shadow shift on the screen and multiplying by a predetermined factor.

This ratio of two measured distances on the tube box is *the only factor requiring to be known* to make the estimation, and it is fixed once and for all in adapting to the particular tube box in use the simple fitting required.

The screen may be at any distance from the tube as found most convenient, there being no necessity to know or measure this distance. Neither need the tube shift be noted or measured; it is controlled by the setting of the foreign body shadow to its two positions. The traverse of the shadow between these two positions alone requires measurement and that proceeding is a familiar one to all workers, while the after calculation is of the utmost simplicity.

Application.—In most tube boxes the central focus-spot on the target of any X-ray tube may be accurately set to the level of the viewing hole and opposite spot (or hole) in the tube box (see fig. 3).

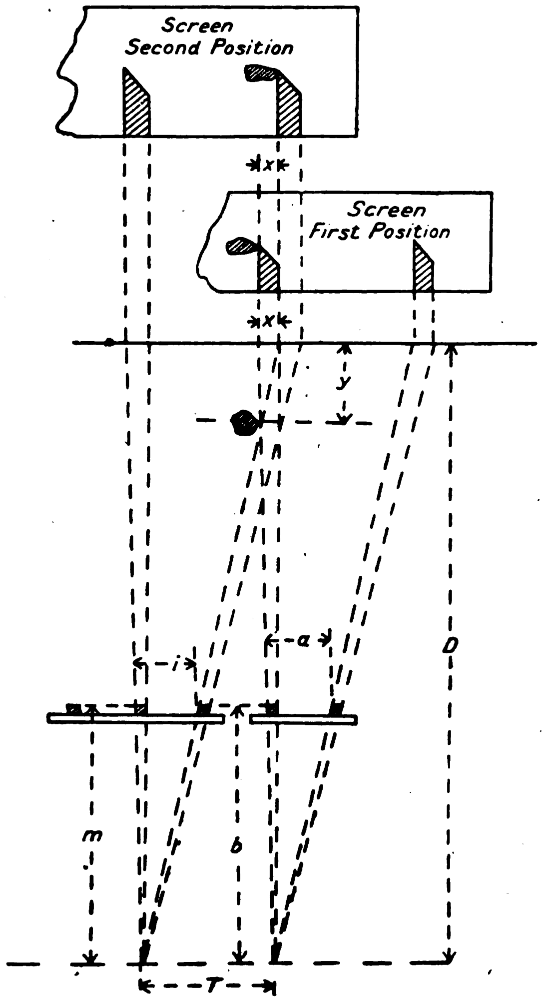


Fig. 2.

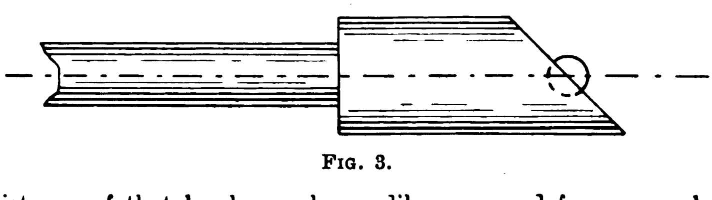


Fig. 3.

The distance of that level may be readily measured from any plane of the tube box fittings at which an opaque bar with slots, or a transradiant plate with opaque bars, may be fitted, and the slots or bars will be placed with their centres

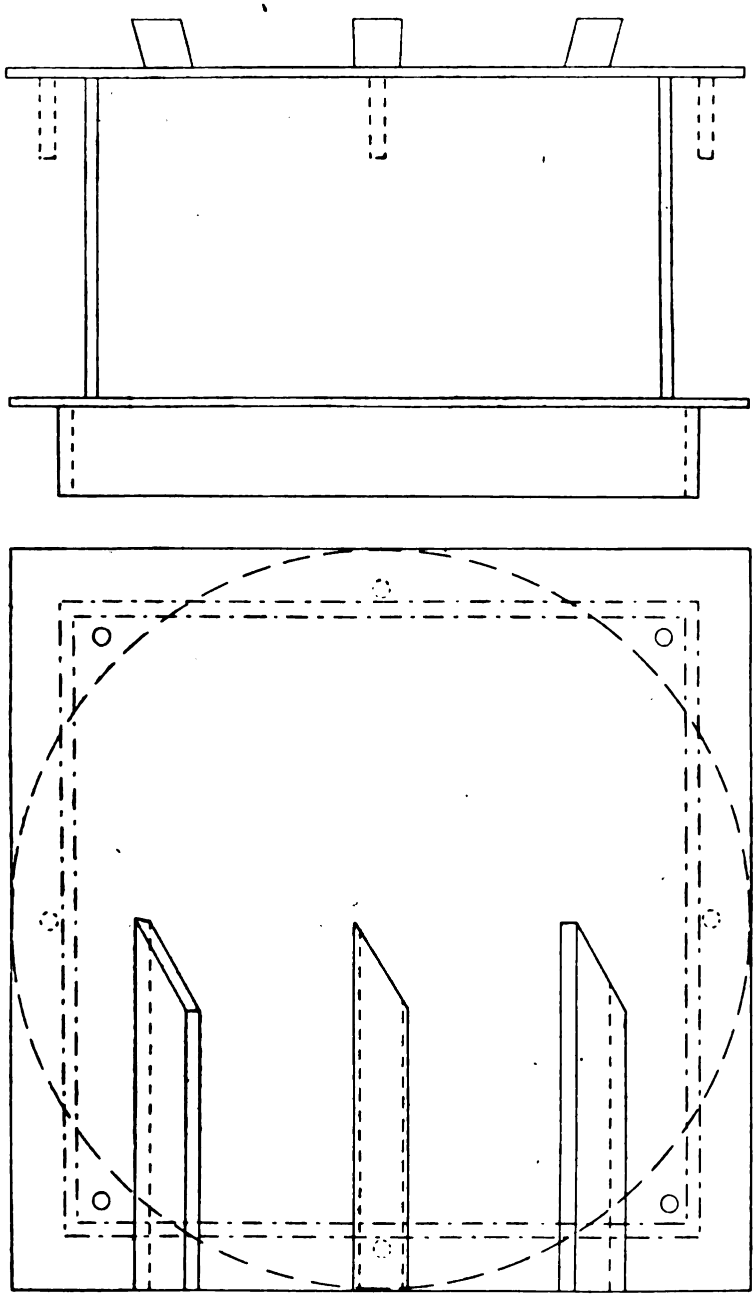


Fig. 4.

at a distance equal to a convenient multiple of that measured distance. The greater that multiple is—that is, the nearer to unity—the less will be the error in result of the calculation arising from inexact measurement of the shadow shift. A very high multiple might involve a longer tube shift than is ordinarily convenient transverse to the table and the distance between the slots or bars is limited by the available opening of the tube box and diaphragm.

By adopting a tube shift parallel to the length of the table the former difficulty may be overcome, and this direction of shift is preferable for other reasons as well; but the dimensions of the tube box must be taken into account.

In practically all tube boxes the opening measures more than one-half the distance of the tube centre from the opening, so that the total width of the localizing "grid" may be arranged to be one-half of its distance above the tube-centre. This will give a ratio of one-fourth on either side of the centre; and the three indicating slots or bars may be fitted, one central and two lateral.

In the earliest models tried (and as described by Roussel) an opaque plate with slots was employed, thus securing a diaphragm effect in defining the foreign body, but the total eclipse of the foreign body shadow in passing from one slot to the other was a grave disadvantage, and later a transradiant plate with opaque bars was adopted.

The plate is of thin sheet aluminium, made to fit on or over the opening of the tube box, and carries on its upper surface three quadrilateral bars of brass pointed at their central end, and set as described above and as shown in fig. 4.

With a restricted tube shift, as when the shift can only be made transverse to the table, and with a foreign body near the surface of the part under examination or situated at some distance to one side of the centre of the width of the table, the two settings will be made to the central bar and one of the lateral bars, and the multiplier to convert measurement of the shadow shift into foreign body depth will be four. This relation is shown in fig. 2.

With a well designed transverse movement of the tube box and a foreign body situated near the centre of the width of the table the settings may be made to the two lateral bars, and the multiplier in that case will be two.

With a convenient longitudinal traverse of the tube box this can always be carried out and this direction of traverse should be employed wherever possible, as the slot opening of the diaphragm in that position does not expose the operator to the emerging rays. The relation is shown in fig. 5.

Figs. 2 and 5 represent the two successive appearances on the screen in an operation for measurement of the depth of the foreign body shown below.

To carry out the measurement one pair of sectors of the diaphragm should be approximated so as to leave only a narrow slot of illumination parallel to the intended traverse of the tube box, and the tube box moved until the shadow of the point of the bar chosen for the first touches a selected prominent point of the foreign body shadow as shown in the accompanying figures marked "first position," and that position must be recorded.

A second setting is then made—as shown in the figures marked "second position"—by moving the tube box towards one side or other as convenient or required until the selected point of the foreign body shadow is touched by the shadow of the point of the second bar.

That second position being recorded, the distance between the two settings

must be noted, and from that the depth of the foreign body from the screen may readily be calculated by multiplying it by the figure expressing the ratio decided upon. Thus, if the bars have been made with their centres at a distance equal to one quarter of the distance above the level of the centre of the tube target, the shadow shift measured as above will be multiplied by four, or by two, to find the depth of the foreign body from the screen, according as the settings have been made to the central bar and either lateral bar, or to the two lateral bars.

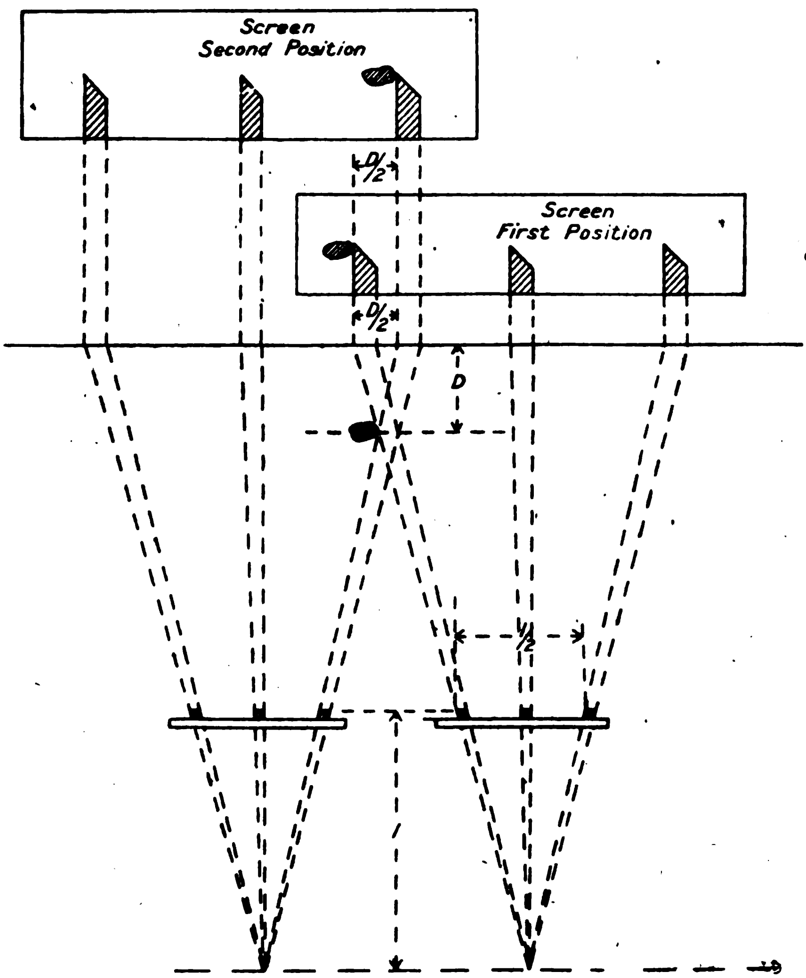


Fig. 5.

The distance between the two settings of the screen shadows may be measured in various ways; probably in practice two indicators attached, and moving parallel, to one side of the screen will be employed. These will be set in turn to the points of contact of the bar and the foreign body shadows in the two successive positions, and the distance between the indicators will finally be measured. Such

indicators moving on the under surface of the screen give more precise settings, but operators will already be familiar with arrangements they have had in use for other methods of screen localization. Small screens with pointers such as that described by Major Thurston Holland may be used very conveniently.

The scale on which the indicators record the distance may be divided into centimetres, and the necessary simple calculation made by the operator, or a scale may easily be constructed to give a direct reading in centimetres of the depth of the foreign body.

Alternative Scale.—Indication of the depth of the foreign body may also be read from the *tube box shift*, but this involves the factor of tube distance, and would impose a certain limitation on the method which is otherwise very general in its application. By reference to fig. 2, the relations determining this latter measurement may be noted. In the figure, D represents the distance of the screen above the centre of the X-ray table, and T measures the tube shift between the two positions of setting to the foreign body shadow.

From the large and small triangles having a common apex at the tube centre, and their bases respectively at levels of the screen and of the grid-plate, it will be seen that : $\frac{T + x}{D} = \frac{a}{b} = \frac{i}{m}$; therefore $T + x = \frac{D}{m}$, i.e., $T + \frac{y}{m} = \frac{D}{m}$, therefore $y = D - T \times m$, i.e., the depth of the foreign body may be estimated by noting the tube shift necessary between the two settings described, and deducting from the tube distance the product of the tube shift multiplied by the factor decided on in the construction of the fitting. When a fixed tube distance may conveniently be employed, a scale may be constructed and fixed so that the shift of the tube between the two settings may be measured and read directly in terms of foreign body depth.

The more general method of measuring the shadow shift on the screen will probably be preferred by the majority of operators on account of its wider applicability with any convenient but undetermined tube distance.

Practical Points.—Since existing tube boxes may not be of uniform dimensions, it is not possible to issue each localizer fitting completely ready for use. For tube boxes which are fixed with the level of their opening at some distance from the table top, the grid plate should be made with supporting pillars to rest on the face of the tube box, so as to bring the plate close up to the table top, and thus secure better definition of the bar shadows.

Adjustment of the distance between the bars may be made by slackening the screws fastening the two lateral bars, and, moving these bars to one or other side, the holes in the plate through which these screws pass being made elliptical in shape to allow of this adjustment. If the bars should become detached from the plate, it must be noticed in replacing them that the sides of each are shaped so as to be parallel to the line joining its upper part to the tube centre, so that their shadow is cast on the screen by the full thickness of the bar, and not by a tapering edge.

This may be seen in fig. 4, which represents diagrammatically, and not to scale, the two forms of the grid plate issued for use with types of tube box commonly issued by the War Office.

For cylindrical tube boxes issued the grid plate is made of a circular shape with a flange on the under side to fit inside the opening of the tube box.

For the rectangular type of tube box issued the plate is square in shape, and mounted on a short pillar at each corner to bring the plate close up to the table so as to secure better definition on the screen.

The plate of either shape may, of course, be turned with its bars either parallel, or transverse, to the length of the table, according as the intended traverse of the tube box is transverse or longitudinal.

If the foreign body be of special shape, the plate may be oriented so that the pointed ends of the bars are turned in any one of four directions, as found to give the most precise settings to the foreign body shadow.

The steps in the process of localization by this method are very similar to those of other processes of screen localization, and its drawbacks are solely those common to screen observations in general.

Compared with other methods, it is more generally applicable under varying conditions, the variable tube distance being a great advantage. Its accuracy depends entirely on a careful initial setting of the bars after measurement of the tube box, and upon ordinary care in measurement of the shadow shift. Coupled with this accuracy, the main recommendation of the method is its extreme simplicity in operation and in the after calculation. Any person totally unacquainted with its theory can with the most simple instructions obtain accurate results from the first time of employing the method.

The simplicity may be judged from the following summary of directions which accompanies each localizer fitting issued.

A.M.D. GRID LOCALIZER.

DIRECTIONS FOR ESTIMATION OF DEPTH OF FOREIGN BODY.

(1) Choose a prominent and well-defined point of the foreign body shadow, and, by moving the tube box, set the point of the shadow of one of the lateral bars to that point, looking along the edge of the bar shadow so as to make the setting accurate.

(2) Register position (1) by setting one of the indicators attached to the fluorescent screen in line with the pointed edge of the bar shadow. (See diagram, "First Position.")

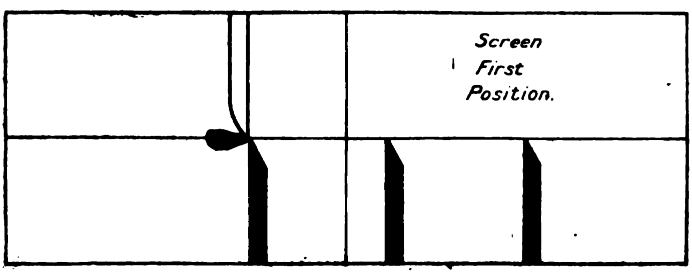


FIG. 6.

(3) Move the tube box so that the shadow of the central bar approaches the F.B. shadow.

(*A*) If this traverse of the tube box be unlimited continue this movement till the shadow-point of the second lateral bar touches the foreign body shadow, and set as in (1).

(*B*) If traverse be limited the tube box movement may be checked when the shadow-point of the central bar touches the F.B. shadow, and the setting may be made in that position.

(4) Register this second position (3) (*A*) or (*B*), by setting the second screen indicator to the line of contact of the shadows as in (2). (See diagrams, "Second Position.")

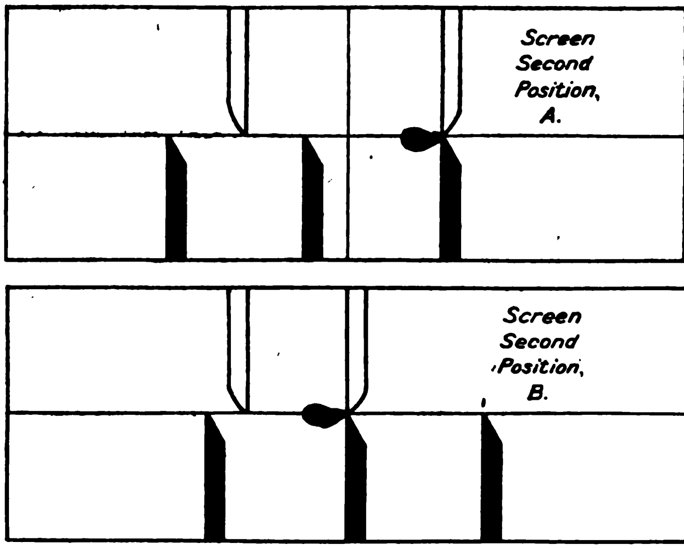


FIG. 7.

(5) Measure the perpendicular distance between the two screen indicators. (See diagrams, "Second Position.")

(6) Multiply the above measured distance :—

(*A*) By *two* if the settings have been made to the two *lateral bars.*

(*B*) By *four* if the settings have been made to the *central* bar and *one lateral bar.* (See diagrams, "Second Position," *A* and *B.*)

The *result* indicates the depth of the foreign body from the *fluorescent screen.*

SOME NOTES ON TRENCH FEVER.

By Captain T. STRETHILL WRIGHT.
Royal Army Medical Corps.

The following notes were begun during the winter 1915-16 and are compiled from clinical observations made on cases admitted to the medical wards of a stationary hospital from the middle of November to the end of March.

Among the very large numbers of cases that came down to us from the Front labelled "influenza" and "P.U.O.," there were some thirty cases of a new type; the curious character of the temperature charts which showed a series of "spikes," occurring at more or less regular intervals and separated by afebrile periods, attracted attention. These cases were carefully observed and a remark-

able similarity was noticed in the symptoms they presented and in the course they ran.

This was before Captain McNee, Lieutenant Renshaw and Captain Brunt, had published in the *British Medical Journal* (February 12, 1916) their exhaustive description of "trench fever"; but the new disease had already been much talked of.

Our cases presented a definite clinical picture unlike that of any known disease, the character of the pyrexia and the symptoms conformed to the type that we had come to associate with trench fever, and before the end of November we had begun to employ this term in diagnosing them.

Incidence.—The cases were all young men or men in the prime of life and the great majority were infantrymen who contracted the disease while in the trenches; there were two or three artillery men who had been living in dug-outs, one A.S.C. man attached to a field ambulance and a couple of R.A.M.C. orderlies, also attached to field ambulances.

In one or two instances it was suspected that patients contracted the disease while in the ward, e.g., cases sent down from the Front labelled "rheumatism," or "myalgia" who had normal or subnormal temperature for a week before the first "spike" appeared on the chart; but since Captain McNee has stated that the incubation period may be as long as twenty-two days, we are not in a position to confirm the suspicion.

Etiology.—The ultimate cause of the disease is as yet a matter of speculation. Permission to perform inoculation experiments here could not be obtained, but the infectivity of the disease has been proved by Captain McNee by its ready transmission from one person to another by the blood, and his experiments also seem to have demonstrated that the virus is contained within the blood corpuscles themselves, whether leucocytes or red cells. As regards its transmission he suggests that "the disease is either contagious from man to man, or what seems much more likely, is carried by one of the common flies or parasites found in the trenches; during the past summer lice, mosquitoes, midges and flies of other kinds have all been common in the Flanders War Zone." The fact that we have been getting cases of trench fever throughout the winter suggests that the infection can hardly be conveyed by mosquitoes, midges or flies. Lice, however, thrive all the year round; further, there has been a perfect plague of rats and mice not only in the trenches but also in the artillery dug-outs and in the barns and stables that serve as billets for the troops, and these vermin, infested as they are by fleas, lice and other parasites, may be the agents that transmit the infection.

Clinical Features.—The onset is generally sudden, according to the accounts given by the men. The majority complained of severe headache and pain in the legs and small of the back. The headache was not uncommonly associated with dizziness, and these symptoms sometimes came on so suddenly and with such violence that the patient was unable to stand and had to be carried to the pressing-station. The pain, in our cases, as far as we could determine, was invariably muscular. Several patients said they had pain in the shins, but on examination there was no tenderness upon pressure on the tibiæ, while pressure on the muscles along the outer and inner borders of the bone caused acute pain. This was in marked contrast to the symptoms presented by another febrile

affection, very common in our wards at this time, to which for convenience we gave the name of "shin fever"; the chief characteristics of shin fever were persistent pain and tenderness in the tibiæ, a low irregular pyrexia generally lasting two to three weeks, "fluffiness" of the tibial periosteum—shown by X-rays, and a marked leucocytosis. There was a certain amount of variation in different cases in the muscles affected, but the infection was invariably bilateral. In some cases the pain in the lower limbs was limited to the anterior muscles of the legs, in others to the muscles of the calves. Pain was frequently felt at the back of the knees and in the muscles of the thighs. In two cases there was no pain at all in the lower limbs but pain and tenderness in the muscles attached to the costal margins, and this pain was much increased by contracting the abdominal muscles, e.g., in the effort to sit up. During the febrile paroxysms which characterize the disease the pain in the muscles and the headache were always worse and there was general malaise, but during the intervening afebrile periods it frequently happened that all symptoms disappeared, the patient felt perfectly well and was allowed to get up and take ordinary diet. The pain in some instances was continuous throughout the course of the illness and in these cases it was sometimes so severe during the febrile periods as to require the administration of morphia. The fever was always associated with loss of appetite and the tongue was generally coated; sweating was a common accompaniment of the sharp falls in temperature. The only other common symptom noted was a tendency to constipation.

The Fever.—In the great majority of cases the illness begins with a sharp rise of temperature, but occasionally there is no fever until the third or fourth day after the appearance of the symptoms. Some of our cases reached us within twenty-four hours of reporting sick and quite a large number within three days. In certain cases it was impossible to determine the length of the initial period of pyrexia as they were sent down from the Front without any notes. However, in the majority of cases it was possible, by starting from the last day on which the patient felt perfectly well and was able to do his work, to fix an outside limit for the duration of the initial fever. A careful study of the history of each case led to the conclusion that the average length of the initial period of pyrexia was two to three days. Captain McNee divided his cases into two classes. In Class A there was an initial period of fever lasting about a week, generally followed by a single relapse. In Class B the initial fever was shorter and was followed by a series of relapses. We, of course, saw far fewer cases than he did, but we found it impossible to classify them in this way. We have a number of instances in which the initial fever lasted only two days and yet was followed by a single relapse; in others an initial pyrexial period of two to three days was followed by several relapses, like Captain McNee's Class B. We have no unequivocal examples of his Class A, which in his experience was the more common type. The accompanying Charts illustrate these points. The first seven show a series of two or more relapses following the initial rise of temperature, the remainder show only a single relapse; in all except two (Charts 3 and 5) there was evidence to show that the initial fever was short.

After reviewing all the cases in which the duration of the initial fever is recorded or can be calculated (comprising the majority of our series), we have come to the conclusion that these all belong to a single type, the characteristics

of which are a sudden onset, with a short bout of fever lasting two or three days followed by one or more relapses. As a general rule the severity of the symptoms is proportional to the height of the temperature, but it seems impossible to predict from the intensity of the fever of onset whether the disease will run a long or a short course, i.e., whether there will be one or several relapses. The relapses recorded on our charts vary from one to three in number; they may occur every fifth, sixth, seventh, or eighth day, but it is uncommon for the spacing to be exactly regular throughout the illness in each case. The most characteristic thing about them is the sharpness of the rise and fall of the temperature, which gives the chart a peculiar "spiky" appearance. The temperature may settle down immediately after the last "spike" or there may be a mild irregular pyrexia lasting a week or so before convalescence is finally established. In most of the cases the pulse during the febrile paroxysms was comparatively slow; it did not often go above 100. After the last relapse a tendency to tachycardia and irregularity of the heart's action was noticed in several cases.

The treatment adopted here was mainly symptomatic, the cause of the disease being still unknown. Various drugs, including pot. iod. and arsenic, were employed, but none were found to have any specific action on the disease. In some cases aspirin seemed to produce some alleviation of the headache; it did not appear to have any effect on the fever or on the pain in the back and lower limbs. In the severest cases occasional doses of morphia were administered. The patients were kept in bed and put on a fluid diet during the febrile paroxysms; in the intervals most of them were well enough to get up and take ordinary food. The treatment of the tachycardia and debility that were often present during convalescence calls for no special comment.

A few words may be added as regards the differential diagnosis.

Examinations of the blood, fæces and urine of a large number of the cases were made by Major Hume and Captain Greenfield, R.A.M.C., with the object (*a*) of discovering, if possible, some clue to the causation of the disease, and (*b*) of excluding the enteric group.

(*a*) Attempts to discover the presence of an organism to which the infection may be attributed have not yet been rewarded with any success. It seems superfluous, therefore, to give an account of the various investigations undertaken with this object.

It may be noted, in passing, that a moderate leucocytosis was found to be a common, but not a constant feature. Punctate basophilia was also observed in the blood films examined; but this phenomenon was also encountered in cases not suffering from trench fever.

(*b*) It had been suggested that the disease was perhaps an atypical form of enteric—"typhoid fever in the inoculated."

The clinical picture presented was all against this hypothesis; e.g., to mention only two points, none of the patients ever had any rash, and in no case was the spleen enlarged or tender. However, the question was finally settled in the laboratory.

All our cases without exception had previously been inoculated against typhoid and this fact had to be taken into consideration in interpreting the Widal reaction. Blood was taken at various times in the course of the disease, at the height of the fever and during the afebrile periods, but in all cases examined the evidence

CHART 1.

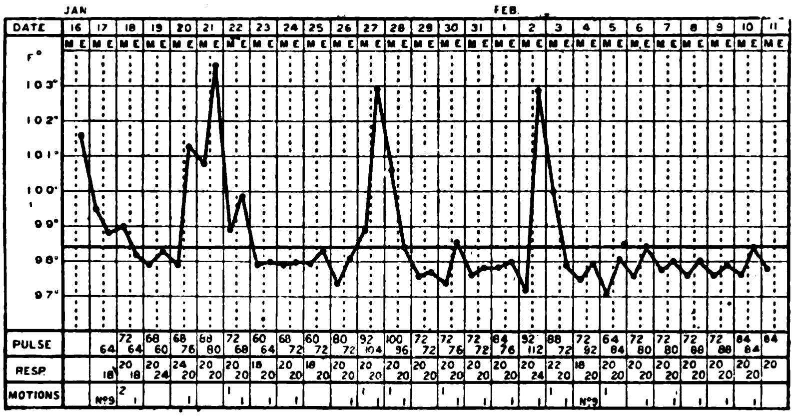


CHART 2.

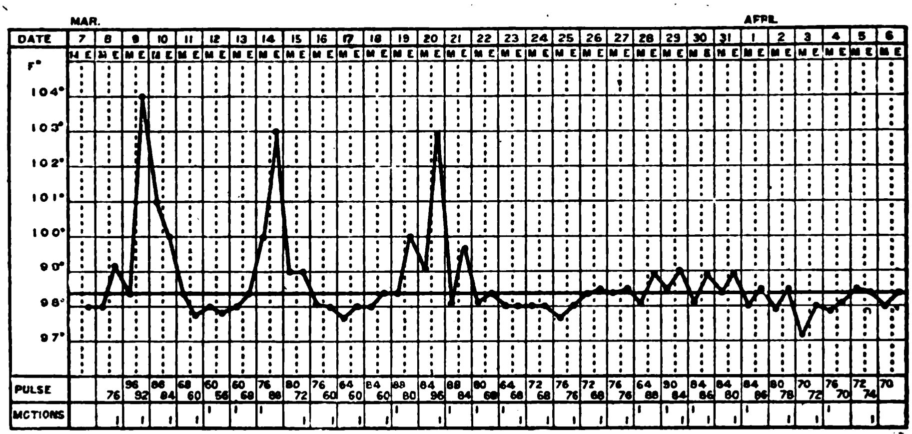
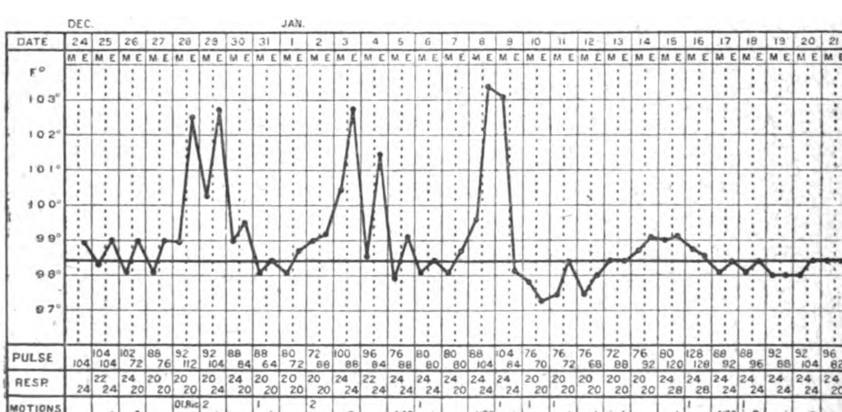


CHART 3.



of typhoid or paratyphoid infection was negative, cultures from the blood all proved sterile, and cultures from the stools also gave negative results. It may be confidently affirmed, therefore, that these were not atypical cases of enteric, but genuine cases of "trench fever," and though it would be imprudent to dogmatize while the cause of the infection remains undiscovered, we can at least say that the disease has every appearance of being a definite clinical entity.

In conclusion, I should like to express my grateful acknowledgments to Colonel Butler, D.S.O., for many helpful suggestions, and to Major Humé and Captain Greenfield for their kindness and patience in carrying out investigations in the laboratory.

BRIEF NOTES EXPLANATORY OF CHARTS.

Chart 1.—Sudden onset on evening of January 14. Temperature had fallen almost to normal within seventy-two hours of appearance of first symptoms.

Chart 2.—Onset two or three days before admission. No fever before March 8. Sent down as case of "rheumatism."

Chart 3.—This patient was taken ill five days before admission. No information could be obtained as to duration or intensity of any pyrexia there may have been during this period. In this case headache and pain and tenderness in abdominal muscles attached to costal margins were the predominant symptoms.

THE CAUSATION OF "TRENCH SHIN."

BY LIEUTENANT J. ALLAN BERRY.
New Zealand Medical Corps.

ALMOST from the beginning of the War and amongst several of the belligerent nations cases of fever presenting a symptom complex different from any previously described disease have been exceedingly common. Various names have been given to it, such as "trench fever," which is much used at the present time but which is recognized as not being very satisfactory since many of the victims of this disease have never been in the trenches, and also it is becoming fairly common among troops in training in England who have never been out of the country. "Lice fever" was suggested since it was thought that lice acted as vectors in the transmission of the disease but they do not seem to be always necessary. "Short fever" has been used but the fever may last for weeks or even months. "Puttee fever" or "gaiter fever" are the terms used by the German and Austrian medical authorities under the impression that gaiters or putties are the determining cause of the "shin" pain which is such a characteristic of a certain class of trench fever.

This view receives support from a recent article in the *Lancet* [1] by Lieutenant-Colonel Graham, entitled "Trench Shin," an infectious fibrositis. In this very interesting and very valuable contribution, Colonel Graham states that "trench shin" is a different disease from "trench fever," and that it is caused in part by the wearing of tight puttees which obstruct the venous circulation and cause a continuous loss of heat, thus lowering the resistance of the fibrous tissue to infection. The assumptions that "trench shin" is a different disease from

"trench fever" and that puttees play anything more than a very subsidiary part in the causation of "shin" pain are both open to grave objections.

Elsewhere [2] I have shown that cases of trench fever may be divided into three groups: (1) Those with simple fever alone; (2) those with fever and "muscle" pain; (3) those with fever and "shin" pain. It frequently happens that a patient at the commencement of an attack would be classified as an example of group (1). Later he develops what I have called for the sake of convenience "muscle pain," but which I agree is really due to a fibrositis, and still later develops the pain in the shins or "shin" pain, or the order may be altered or the characteristics of groups (2) and (3) may be combined. Colonel Graham I assume would say that cases of groups (1) and (2) were really "trench fever," and that cases of group (3) were "trench shin." If he does we must assume that mixed infections are extremely common but it is easier to believe, in the absence of any definite bacteriological evidence, that these three classes, which are not always sharply marked off from one another and which often merge into one another, are really manifestations of the same organisms.

Assuming that this view is correct it would be expected that, if puttees were important factors in the causation of "shin" pain, all cases suffering from trench fever would develop "trench shin," as most men wear puttees. As a matter of fact only a certain number develop the "shin" pain and tenderness and it is necessary to look for some reason other than puttees for the selection of the shins as one of the sites of "bone" pain.

The great majority of British soldiers wear an inelastic non-spiral puttee extending from above the ankle to below the knee-joint. The puttee is usually put on over trousers. These are pulled up above the level of the boot, folded over as one would do when putting on bicycle clips and the puttee applied. One area of maximum constriction is about the junction of the middle and lower third of the leg: (1) Because boot laces are often wound round the upper part of the boot and tightly tied; (2) because the puttee is usually put on there and two or three tight turns are given to hold it in position; and (3) because the lower folded part of the trousers forms a pad over which the puttee is placed. The other area of maximum constriction is below the tibial condyle because: (1) here the puttee ends and the tape is firmly bound round many times; (2) in the case of officers wearing breeches this is the narrowest part. The intervening portion of the puttee is more or less loose since the action of the calf and other muscles causes a certain amount of free play. That this is so can easily be confirmed by examining the legs of men who have removed their puttees after a route march, when red bands will mark these positions. Assuming that constriction has anything to do with the "shin" pain the areas of maximum shin tenderness ought to be the junction of the lower and middle thirds of the tibia and in the upper third. Colonel Graham says that the lower third is protected by the boot and that consequently this part escapes. My experience of cases during last winter in Amiens was that the lower third was more often and more severely affected than any other part of the bone.

The soldiers of the Belgian Army and some of our Scotch regiments wear a puttee covering the lower third of the leg only. Amongst the Scotch regiments I have seen most severe "shin" pain not confined to the lower third but affecting the whole length of the bone. The same applies I believe to cases seen in the

Belgian Army. Then again many of our men for special reasons have not worn puttees. These men have, when affected, had in some instances the most violent and extensive "shin" pain. I have recently heard of one of the sisters in the New Zealand Forces who developed trench fever with severe shin pain.

In many cases on examining the shins only certain localized areas about the size of a shilling will be found to be tender. These could not be explained by the puttee theory. Since puttees are worn on both legs it would be difficult to explain those numerous cases where one leg is very badly affected and the other leg is only slightly affected or free from pain altogether! Pain and tenderness over the tibia is very common, and the constriction due to puttees is brought in as the reason. But pain and tenderness in other bones such as the humerus, the ulna, etc., is quite frequent and could not be explained by any theory of constriction. It seems that there must be some other reason for this pain than constriction, and that "trench shin" cannot be a clinical entity.

In group (2) of cases of trench fever, viz., those with "muscle pain," it will be found that the pain is most intense in places that have the maximum amount of fibrous tissue, thus confirming Colonel Graham's theory of an infectious fibrositis. Such places for example are the sole of the foot, the thick aponeurosis covering the upper half or so of the anterior group of tibial muscles and from which in part they take origin, the quadriceps tendons, the fascia lata and the thick intermuscular septa of the thigh, the thick aponeurosis of the forearm which is attached to the ulna and helps to give origin to some of the forearm muscles, the tendinous intersections of the deltoid, the intermuscular septa of the arm, the ligamentum nuchæ and the thick masses of fibrous tissue near the base of the sacrum. In all these places pain is present and is readily explained on the theory of it being the result of infectious fibrositis. The tendinous origins of the abdominal muscles from the lower ribs are also frequently affected giving rise to symptoms resembling pleurisy or pleurodynia, the pain in the calves on pressure may be inflamed by the various aponeuroses and intermuscular septa deeply situated in these regions being inflamed.

The theory of trench fever being an "infectious fibrositis" may also be used to explain the neuritic symptoms. The fibrous tissue surrounding nerves may be affected and thus account for the tenderness of the ulnar, median, sciatic and other nerves in various parts of the body, and also for the paræsthesia, tingling, etc., that is also present in the hands and feet.

The pain present in cases of group (3), viz., those with fever and "shin" pain is really the same kind of thing but affecting mainly the periosteum which is histologically largely fibrous tissue. The hyperæmia causes swelling and affects the nerve endings thus accounting for the severe "bone" pain. What the determining factor is in causing the fibrous tissue of the periosteum to be more liable to be affected in some cases than the fibrous tissue in other situations at present is unknown, but is analogous in the selective action of strychnine for example on nerve tissue, of which there are many examples in medicine.

For the preceding reasons it seems clear that "trench shin" is not a distinct clinical entity but merely a variety of trench fever, and that puttees have little if any share in the causation of "shin pain."

REFERENCES.

[1] Graham. *Lancet*, 1917, vol. i, p. 752.
[2] Berry. *Guy's Hospital Gazette*, September 8, 1917.

A DIAGNOSTIC SIGN IN TRENCH FEVER.

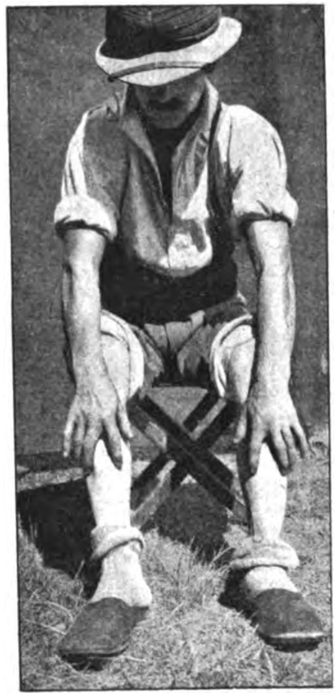
By Major C. S. McVICAR.
Canadian Army Medical Corps.

In recent months, cases of pyrexia admitted to Hospital in the —— area, have been, for the most part, eventually classified as:—

(1) Trench fever.
(2) Recurrent malaria.
(3) Trench fever co-existing with malaria.
(4) Trench fever occurring in a patient who has had malaria.
(5) Typhoid and paratyphoid, occurring in inoculated men.

Excluding those cases of malaria in which parasites were easily demonstrated and those cases of enterica which gave positive hæmo-cultures, there still remained a large proportion of cases where a diagnosis could be made with reasonable accuracy only after a week or ten days observation and laboratory study. This fact led one to search for any clinical signs as aids in early differentiation for the purpose of segregation as well as for treatment.

Our experience of several hundred cases has led us to look for a sign in trench fever, which, while not constantly present, is sufficiently frequent to be of great value. The sign depends partly on the unusual location of the pains in this disease and chiefly upon their symmetrical distribution. It is observed when a patient is asked to indicate the exact location of the pains. This he does by using both

hands as in the illustrations. Thus pains in the "shoulders" are indicated by reaching one hand across the body to the opposite trapezius muscle and immediately reaching the other hand to its opposite trapezius. Again, pains in the "knees" are shown by sweeping the hands simultaneously downward over the popliteal spaces or more frequently by grasping each patella with the thumb and forefinger of the corresponding hand and moving the hands up and down the patellar tendons. Pains in the "legs" are frequently demonstrated by straddling

the anterior borders of the tibiæ with the first and second fingers of the corresponding hand and sliding the fingers gingerly up and down. The ends of the fingers of each hand are swept from the middle line outward along the costal margins to indicate pain in the costal attachment of the abdominal muscles. Characteristic symmetrical gestures are also used to delimit pains in the head, back and thighs.

Further, in those rare cases where the pains are not symmetrical, one hand is used by these patients in the same gingerly but exact fashion that the majority use to indicate the bilateral pains.

A CASE OF PERFORATION OF A GASTRIC ULCER DUE TO AN ACCIDENT.

By Captain KENNETH BLACK.
Royal Army Medical Corps.

Mr. C., an accountant, aged 41, had been troubled with wind and slight attacks of indigestion for several years. In August these attacks became more marked and were accompanied with vomiting. He therefore took a holiday and indulged in fresh air and golf. On September 12 he had his usual hearty lunch at 1.15 p.m., and then started a game of golf. At the second hole he made an unusual effort to obtain a long drive and immediately was doubled up with pain and collapsed. This occurred at 2.15 p.m. He was not sick and did not feel sick. He was taken to his hotel, and I saw him at about 6.45 p.m. The heart-rate varied, and would be 66 one moment and two or three minutes later it would be 100. There was pain, tenderness and rigidity in the hypogastric and right epigastric regions; the liver dullness was diminished; temperature, 98·8° F. There had been no vomiting. A perforated gastric ulcer was diagnosed and the patient removed to the hospital, where I performed an operation the same evening. On the anterior surface of the stomach at the pylorus I found an old ulcer with a medium-sized perforation, through which a good deal of stomach contents had escaped. The perforation was closed and some omentum stitched over the ulcer; the abdominal cavity was rapidly mopped clean and the abdomen closed. The patient had some vomiting for the first thirty hours after the operation, otherwise he made an uninterrupted recovery.

The interest of this case lies in the fact that it would appear that the immediate cause of the perforation was a sudden strain or "accident." Any disease or illness that is brought about by an accident is of great importance for the purposes of the Workman's Compensation Act. In this case had the patient been a working man or woman, and had the strain occurred whilst he or she was at his or her employment, it seems probable that it would have been held that there had been an accident which had arisen out of and in the course of his or her employment, and the patient would have been paid compensation during the time of incapacity, or, in the case of death, compensation would have been paid to the relatives. If an ulcer became perforated at the time of a strain, it would be assumed to have been caused by the strain, as the following classic case illustrates. A workman had a large thoracic aneurysm, and whilst at his work the aneurysm suddenly gave way and the man expired. In this case it was held that the workman must have had a strain or "accident" to cause the aneurysm to burst, and as the "accident" arose out of and in the course of the man's employment, his relatives received compensation.

A CASE OF SPIRILLUM FEVER IN (GERMAN) EAST AFRICA.

By Major J. H. REFORD, U.M.S., M.D., B.A.O., B.Ch., D.T.M.
Officer commanding Advanced Base Hospital, Mwanza,

AND

Captain H. L. DUKE, U.M.S., M.D., B.C., D.T.M. & H.
Bacteriologist, Uganda Protectorate.

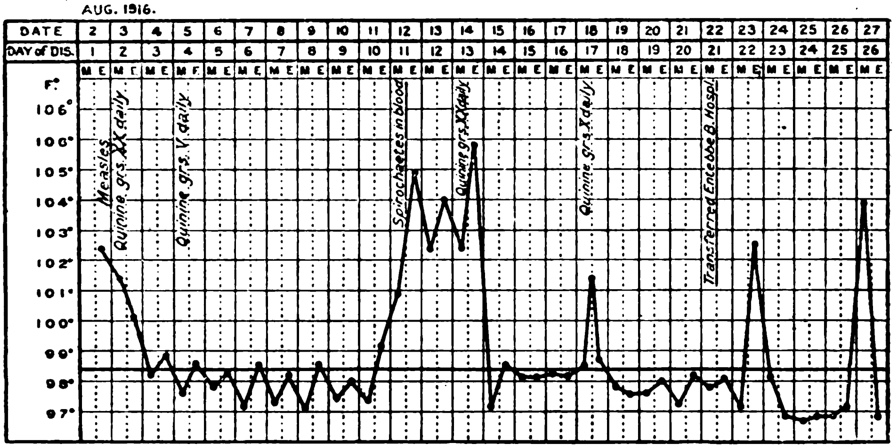
History.—The patient, Captain M., a strong built, good constitutioned man of 28 years, was taken ill towards the end of July, while on "safari," a few days out of Mwanza, German East Africa, and compelled to return. He was admitted to hospital on August 2, under the diagnosis of measles. The attack was typical and somewhat severe, koplik spots, fever, coryza, and rash being all in evidence. The day before reaching Mwanza he was badly bitten during the night by spirillum ticks (*Ornithodorus moubata*), a large number of which were found in his bedding on the following morning. He was bitten a number of times during this night (August 1—2), probably by a considerable number of ticks.

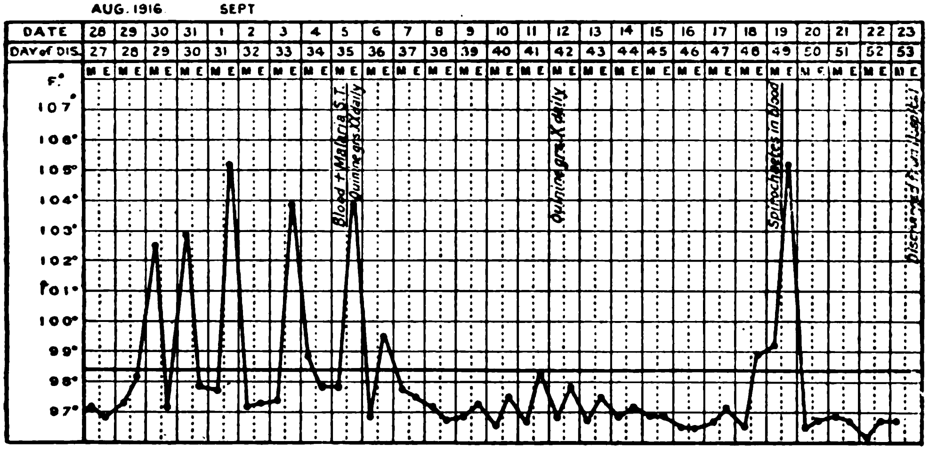
Progress of Case.—On his admission to hospital the fever and other symptoms of the measles soon subsided, as is shown in the attached temperature chart. On the 11th the temperature began to rise again, and on the 12th spirochætes were found in the peripheral blood. No malaria could be demonstrated. The first spell of fever lasted four days, the temperature reaching 105·8° F. On August 14 quinine was started in doses of twenty grains daily, reduced on August 18 eight to ten grains a day, which was continued until his transfer to Entebbe Base Hospital on August 22.

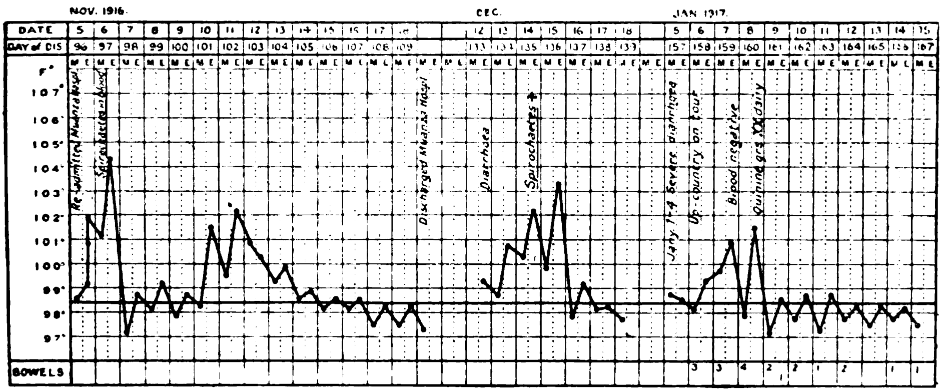
Isolated rises of temperature occurred on August 18, 23, and 27, reaching respectively 101·4°, 102·5°, and 103·9° F., the temperature in the intervals being generally subnormal. It may be remarked here that patient says his temperature during health in Uganda is generally subnormal. On August 30, the twenty-ninth day after admission to hospital, another spell of fever commenced with at first daily and then alternate daily intermissions to subnormal levels, and on September 5 a blood examination revealed subtertian malaria—a condition suggested by the diurnal periodicity of the fever. Quinine was recommenced in doses of twenty grains daily, dropping to ten grains daily on September 12, and an immediate fall of temperature ensued. No spirilla were seen on this occasion.

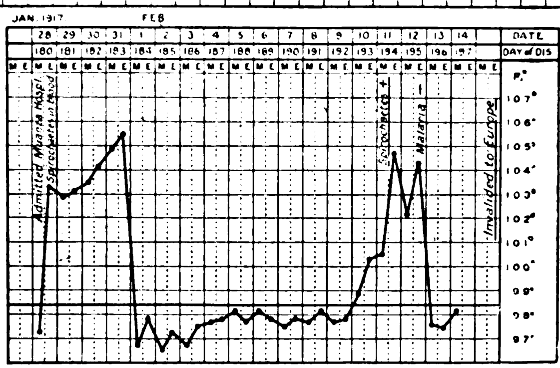
The next spirillum relapse began on September 18, the forty-eighth day after admission, and on the following day the temperature rose to 105·2° F., falling to subnormal the next day. Spirochætes were again found in the peripheral blood.

In the eleven days' interval between the elimination of the malaria and this last relapse of the spirillum fever, the patient felt in excellent health and spirits, though he was easily tired; he ate and slept well, and took mild exercise in the cool of the evenings. On September 23 he was discharged from hospital, but was kept under observation for three weeks, at the end of which time it was deemed safe to return him to duty. He remained in excellent health until November 5, when he was re-admitted to Mwanza hospital with pyrexia ninety-six days after his first admission. On the following day spirochætes were found, and no malaria, though the blood was taken and examined on two occasions. The spirochætes were scarce in these slides. On November 18 he was discharged from hospital, but kept under observation for fourteen days.


AUG. 1916.
DATE
DAY of DIS.
F°
Measles
Quinine grs. XX daily
Quinine grs. V daily
Spirochaetes in blood
Quinine grs. XX daily
Quinine grs. X daily
Transferred Entebbe B. Hospl.


AUG. 1916
SEPT
DATE
DAY of DIS.
F°
Blood + Malaria S.T.
Quinine grs. XX daily
Quinine grs. X daily
Spirochaetes in blood


NOV. 1916.
DEC.
JAN. 1917.
DATE
DAY of DIS
F°
Re-admitted Mulago Hospl.
Spirochaetes in blood
Discharged Mulago Hospl.
Diarrhoea
Spirochaetes +
Up country on tour
Blood negative
Quinine grs. XX daily
BOWELS


JAN. 1917
FEB
DATE
DAY of DIS
F°
Admitted Mulago Hospl.
Spirochaetes in blood
Spirochaetes +
Malaria
Invalided to Europe

No further fever troubled him until December 12 when he was re-admitted to hospital, and spirochætes were again found on December 14, the one hundred and thirty-fifth day after his first admission. Diarrhœa appeared for the first time during this relapse.

On January 2, 1917, while on tour in the neighbourhood of Mwanza he was attacked with diarrhœa, his companion, Captain W., showing the same symptoms simultaneously. Both officers had drunk some doubtful water on the previous evening. One of us, who had not seen Captain M. since diagnosing the relapse of November 5, and was ignorant of the intervening medical history, was with the expedition and, at first, as the temperature of both officers remained normal, treatment was commenced on purgative and antiseptic lines. Captain W. recovered in a day or so, but on January 15 Captain M.'s temperature rose above normal and on the 8th reached 101·5° F., the diarrhœa persisting. Two different blood examinations on January 7, 1917, proved negative to both malaria and spirillum, though a slight relative large mononuclear leucocytosis was observed. Quinine was administered in doses of twenty grains daily, and the diarrhœa subsided together with the temperature. The patient was much weakened by the attack and was sent back to Mwanza. Again ensued a spell of apyrexia, which lasted until January 28; during this period the patient was under medical observation and doing light duty. Then on January 28 he was re-admitted to Mwanza Hospital, and that night the temperature rose to 103·3°, reaching 105·5° F. on January 31. On the 28th spirochætes were again found in the blood. Yet another relapse occurred on February 10, the one hundred and ninety-fourth day after his first admission, when spirochætes were once again found. A search for malaria parasites on February 12, proved negative. The patient was then invalided to Europe.

Remarks.—The onset of the spirillum fever commenced on August 11, ten days after the infection by the ticks. The high temperature on September 1 may certainly be ascribed to the spirochætes and constitutes the first definite relapse, complicated by malaria.

The rises occurring during the interval between these two spirillum manifestations are curiously irregular. Only subtertian malaria was found, but it is possible that another type was also present, as the tertian parasite is common in the Mwanza district and the quartan organism is also reported in the German records.

It is probable, however, that a partially suppressed relapse of the spirillum fever was represented by the pyrexia of August 23. This date corresponded to the period at which the first relapse was expected, and it is not uncommon in our experience to find one or other of the relapses partially or completely suppressed, or to fail in finding spirochætes in the peripheral blood even in some of the well defined relapses.

The second relapse was well defined and occurred after an interval of eleven days of subnormal temperature.

The real interest of the case now commences. Between the second and third definite relapses there was a period of forty-six days apyrexia, during which time the patient was in excellent form and experienced neither subjective nor objective symptoms. Then came the third relapse, of a slightly irregular character, terminating we will say on November 16, and followed, after a twenty-five days interval, by the fourth relapse of a milder nature than its predecessors. After

another interval of nineteen days, the sixth pyrexial period commenced, accompanied by diarrhœa. On this occasion blood examination failed to reveal spirochætes, but it is highly probable that this attack represents the fifth definite relapse. Except for the diarrhœa this was the mildest of all the manifestations. Seventeen days later spirochætes were again found in the blood, the temperature during this sixth relapse reaching 105·5° F. Spirochætes were once again found after a further interval of nine days, this constituting the seventh definite relapse, occurring one hundred and ninety-three days after the patient's first admission and some one hundred and ninety-five days from the date of his actual infection by the ticks. After his admission into hospital on August 8, 1916, the patient was not exposed to any chance of re-infection by ticks.

The exigencies of active service precluded any consultation of the current literature of spirillum fever, but the case is undoubtedly a remarkable one. The long period of apyrexia between relapses two and three during the greater part of which the patient was going about his duties unconscious of any inconvenience whatever; the absence throughout of any signs of iritis or facial paralysis which are such common complications in European spirillum cases in Uganda; the relative absence of headache during the fever spells: the coincident infections, first measles and then malaria; the diarrhœa, present only during relapses four and five; the regularity and relative ease with which the spirilla were found, even in the later relapses; the number of relapses and the expectionally prolonged duration of the infection—all these features will, we hope, justify the publication of the case.

It is possible that the lowering of general resistance produced by the initial attack of measles enabled the spirochætes to establish themselves unusually firmly in the system, a similar effect being produced by the superimposed malarial attack during the first relapse. Considering the number of ticks seen at the original infection, the patient may well have received several strains of spirochætes. The bad water drunk a few days before the fifth relapse may have caused the diarrhœa, with consequent lowering of resistance and recrudescence of the spirilla, or, the diarrhœa itself may have been a manifestation of the disease.

In each case where spirochætes were found in the blood, stained slides were examined, and, except in the single instance of the first relapse, malaria organisms were absent on each occasion. The administration of quinine, even when no malaria parasites were found, was carried out as shown on the chart, as it was at times impossible, owing to pressure of work, to undertake the prolonged examination of the slides necessary to finally exclude all malarial elements.

The treatment for the spirillum fever itself was mainly symptomatic, with protection of the eyes, and maintaining the resistance as far as possible against relapses. The use of salvarsan was not resorted to in this case, as the results of our recent experience of this drug in several cases of spirillum fever at Mwanza Hospital have been so unsatisfactory that we have discontinued its use in relapsing fever.

Reviews.

Fields and Battlefields. By 31540 (R.A.M.C.). London: Constable and Co., Ltd. 1918. Price 5s. net.

Deals with some doings of a small medical unit in the days of the battles of Loos and the early Somme. The accounts of the devotion and kindness of the French people are well told. The mixture of a little unvarnished language of the soldier with much philosophy and not a little religion, would appear to detract from the merits of a book which is, nevertheless, occasionally amusing and worth reading.

H. S. D.

Lessons in Massage. By Margaret D. Palmer. Fifth Edition. London: Baillière, Tindall and Cox. 1918. Pp. ix + 346, $8\frac{3}{8} \times 8\frac{1}{4}$. Price 10s. 6d. net.

The appearance of the fifth edition of this book is sufficient to show that it must have fulfilled a purpose, but that purpose could be greatly facilitated by the introduction of some obvious improvements. There is an amount of anatomical detail over and above that necessary for a practical masseuse, and which goes the way of much of the detail learnt by medical men even when the knowledge is acquired by practical dissections—it is learnt for examination purposes and then forgotten. It would facilitate a study of the contours of the body and limbs and of the muscles if these were clearly depicted by surface markings, giving at the same time a dissected view. As the movements in massage are essentially of a practical nature they can only be acquired by practice under an instructor, and to labour the details of movements and manipulations as the authoress has done is unnecessary in an ordinary text-book.

If a chapter on spinal curvature has to be put in a book on massage, it would be better to illustrate by a few diagrams how alterations of posture tend to produce curvature by change in the distribution of the weight of the body, and leave it at that. No masseuse should be left to diagnose or treat such cases, as is too often done. Mrs. Palmer says: "A surgeon sends a case to a masseuse in the belief that she understands her work, . . . as he may give her no definite instructions." The pathology of lateral curvature has been a source of differences of opinion amongst surgeons of vast experience for generations, and the treatment is still a subject of absolutely opposed methods, and all eminently unsatisfactory as regards correction of the spinal deformity; though symptoms, as pain, can be speedily relieved. The optimistic view which might be gained from Mrs. Palmer's presentation of the subject is not borne out by observed results.

The importance of lateral curve being due to inequality of the length of the legs is not emphasized—if that be rectified, no other treatment is usually necessary. The writer has known of many cases being put through Swedish remedial exercises month after month, where the deformity was due to inequality of the legs, naturally with no benefit. If exercises are performed in such cases, such treatment should be carried out with the inequality rectified. The tables laid down for treatment of spinal curvature have proved useless for the correction of bony deformity, at all events in this country.

Mrs. Palmer reiterates the mistaken idea that there is a distinction between educational exercises and those intended for curative purposes. All educational exercises can be adapted to curative purposes, and to attempt to teach otherwise is to limit the usefulness of anyone who is called in to treat disabilities.

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of the

Royal Army Medical Corps.

Original Communications.

THE CLOSURE OF CAVITIES IN BONE.

BY LIEUTENANT-COLONEL PERCY SARGENT, D.S.O.

ANY one who returns to surgical work at home with an experience of war wounds which is largely limited to their earlier stages, will find many surprises in store for him, some pleasant and some unpleasant. He must be careful not to be deceived by the apparent predominance of the latter. Good results are less insistent than bad; the patients pass more quickly through hospital to convalescent home or depot, and make less impression on the mind than those whose wounds provide difficult problems, and who remain long in hospital.

One of the most striking things is the large number of old cases of gunshot fractures with persistent sinuses. My attention was called to this fact from the circumstance that many cases of nerve injury are associated with such sinuses, and operations upon the nerve have, unfortunately, to be delayed in consequence. As it is important to operate upon these nerves as early as possible, it is necessary to devise some means of getting the wounds healed quickly and soundly.

The periodic curetting of a sinus leading into bone is a practice which merely illustrates the triumph of hope over experience. Even the removal of a sequestrum does not of itself ensure sound healing when a cavity of any size exists.

The processes of repair in bone differ in no fundamental respect from those which occur in other vascular tissues, but they are modified by its peculiar and complex structure. Other things being equal, tissues in general heal well or ill according to their vascularity, for a good blood supply means the rapid assemblage of all the elements necessary for the building up of new tissue, and the removal of waste products. Thus, a

wound of the face heals more rapidly than a wound of the back. Bones vary in their vascularity according to their density, and so we find cancellous bone more adapted for recovery than compact bone, and young bones than old. The denser the bone the more readily does necrosis occur; the less easily do sequestra separate, and the more slowly is healing effected. Thus the normal structure of bone handicaps its reparative powers, and this handicap becomes still greater in the case of the abnormally dense bone which results from chronic inflammation.

There is another factor which retards the healing of cavities in bone. The obliteration of an abscess cavity, after evacuation of its purulent contents, takes place principally by the approximation of its walls, and in proportion as this process is prevented healing is retarded. Contrast two common peri-visceral abscesses, an appendix abscess and an empyæma; in the one all the walls are collapsible, and the abscess, after evacuation of its contents, may heal in a few days; in the other, the chest wall is, for practical purposes, uncollapsible, and, unless the lung can expand so as fully to replace the pus, healing may be indefinitely delayed—may, in fact, never occur unless the outer wall is made collapsible by removal of the ribs.

In order that a cavity may become obliterated, and firmly and finally healed, its walls must be approximated until the granulations which cover them are able to coalesce. Sir James Paget [1] called attention to "the error of such expressions as 'filling up with granulations,' commonly applied to deep healing wounds, as if granulations increased in thickness till they attained the level of the upper margins of deep hollows." "The truth is," he continues, "that, even in the deepest open wounds, the granulation-layer is, as usual, from one to three lines thick; and that, when such a wound grows shallower in healing, it is not by the rising of the granulations, but by the lowering of its margins." Two processes combine to bring about the coalescence of the granulations covering the wall of the cavity; one is the falling together of the adjacent structures which, having been displaced by the accumulation of pus in an abscess, seek to resume their normal positions; the second is the process of contraction which is always associated with the development of granulations. This shrinkage of the new tissue is thus described by Paget: "The form of the cell, while elongating into a fusiform body, is so changed that it will occupy less space. The whole mass of the developing cells becomes more closely packed, and the tissue that they form becomes much drier; with this also there is much diminution of vascularity. Thus, there results a considerable decrease of bulk in the new tissue as it develops itself. . . ."

"The force with which the contraction is accomplished," he goes on to say, "is often enormous. Deep scarred and seamed depressions even of the bones, may be produced by the contraction of granulations and scars over them."

If we now turn to a bone cavity, it is clear that neither can its walls

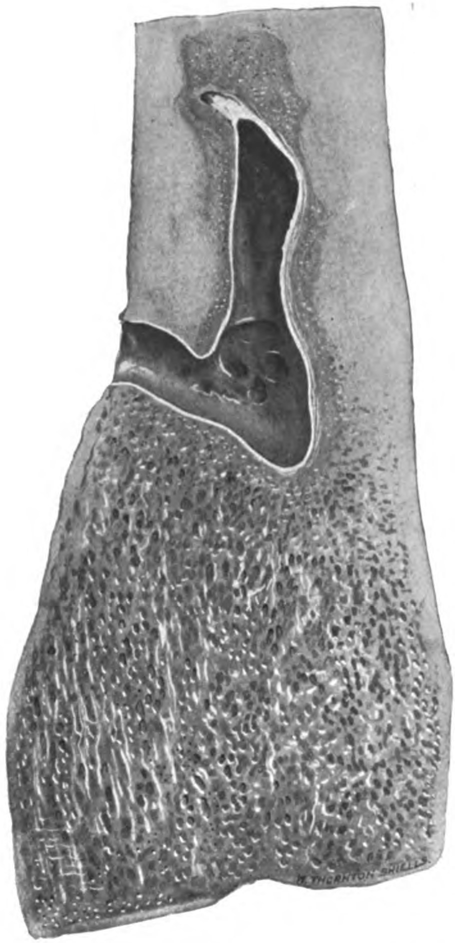

FIG. 1.—Cavity of many years' standing, resulting from necrosis, in the lower end of a femur. (St. Thomas's Hospital Museum, No. 515 D.)

FIG. 2.—Section of wall of cavity shown in Fig. 1. It shows (1) a layer of pus; (2) a film of coagulated exudate enclosing many polymorphs; (3) a zone of typical vascular granulation tissue; (4) successive layers of fibrous tissue in various stages of maturity. $\frac{2}{3}$ objective.

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fall together by reason of the pressure of the surrounding structures, nor can they be drawn together by the contraction of the developing fibrous tissue. Nevertheless, some such cavities do in fact heal. It is, however, a matter of common experience that the wounds often remain insecurely closed, and are liable to reopen, even after the lapse of years, owing to some apparently trivial cause. This is because there exist mechanical factors which prevent the shrinkage that appears to be essential to sound healing.

Although, as Paget says, a cavity is not filled by granulations, yet its dimensions become reduced by the formation of new tissue. Is there then a limit to the size of a cavity which can be filled entirely by such tissue? It has been supposed that there is, and that the limit results from the contraction of the newly formed fibrous tissue constituting its wall. For in the wall of such a healing cavity all stages in the evolution of scar tissue are found, from the most recently formed embryonic tissue at the surface, to fully mature cicatricial tissue below; this, by reason of the tendency to shrink, which is characteristic of newly formed scar tissue, and its diminished vascularity, consequently deprives the surface layers of their source of growth. Therefore a time would ultimately arrive, it may be argued, when the filling up of a cavity would cease from lack of blood supply. The less vascular the foundation upon which this mass of granulation tissue is to be built, the slower will be the process and the sooner it will come to an end.

The study of an old bone cavity, such as that illustrated in fig. 1, teaches us that this hypothesis is not altogether sound. The history of the case from which this specimen was taken is as follows:—

The patient was a man, aged 50. Eighteen years before the amputation was performed, he had been kicked by a horse over the right femur; a few weeks later an abscess was opened, which continued to discharge for two years, when a sequestrum four inches long was removed. The wound healed, but soon broke down again. Another sequestrotomy was performed, six months before the amputation, but still the discharge persisted. At the time that the limb was removed the urine contained a large quantity of albumin.

The section of the wall of this cavity (fig. 2), kindly prepared by Professor Shattock, shows the following zones from within outwards:—

(1) A layer of pus; (2) a film of coagulated exudate enclosing many polymorphs; (3) a zone of typical, vascular, granulation tissue; (4) successive layers of fibrous tissue in various stages of maturity.

Has this cavity, then, filled up to this point with new tissue, and has the healing process come to an end for the reasons suggested above? Apparently not, for the granulation tissue is by no means avascular.

This cavity had been in existence for sixteen years after a two-year-old sequestrum had been removed from it. This should have allowed ample time for a progressive cicatricial contraction to have rendered the granula-

tion tissue completely devoid of blood supply. The fact appears to be that cicatricial contraction in new-formed fibrous tissue comes to an end when that tissue has reached its full maturity. The cavity measures three inches in length ; the sequestrum removed was four inches long. It has, therefore, taken sixteen years for the cavity to be reduced in length by one inch.

We may therefore suppose that the process of filling up a bony cavity by the growth of new tissue upon its walls, whilst it may slow down, does not necessarily come to an end completely ; that, although in theory a cavity of any size might ultimately be obliterated in this manner, the process would be so slow as to need longer than the lifetime of the patient, a lifetime apt to be shortened by chronic septic absorption, or by any of the accidents which threaten a patient who bears a source of chronic suppuration.

Therefore, whilst no such cavity may be beyond the possibility of obliteration, given sufficient time, we have to realize that, for practical purposes, some assistance must be afforded so to hasten the healing process as to bring it about within a reasonable period.

The condition of the interior doubtless varies in different cases. In some the granulating surface may be well vascularized and freely suppurating; in others, where little purulent discharge is present, it may resemble the indolent or callous ulcer, with its fibrous floor and no obvious granulations (fig. 3).

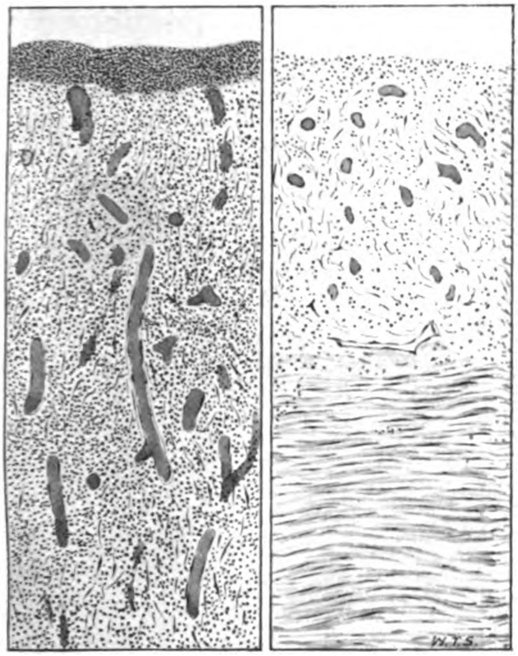
In all probability, the reasons why a callous ulcer fails to heal are, in the main, the same as those which prevent the healing of a cavity in bone; the ulcer is poorly supplied with blood, whilst the adhesion of its floor to the underlying deep fascia, or bone, prevents its area from being lessened by contraction. Contraction seems to be an essential part of the healing process. Possibly in its unavailing effort to diminish the size of the healing area, the contractile power of the fibrous tissue is wholly expended upon itself. The structures in the new mass which would suffer most under such circumstances would be the blood-vessels.

This general shrinkage must diminish the size of the blood-vessels, and it may be presumed to continue until the volume of blood passing through the mass is only sufficient for the needs of the new tissue already formed, leaving none to spare for further growth. When this hypothetical state of equilibrium is established healing will cease.

In this manner, the very property which, if allowed to have unhindered play, is the chief factor in "healing by granulation," in the adverse circumstances obtaining in the case of an adherent ulcer, or an uncollapsible cavity, acts in an adverse direction, and ultimately brings the healing process to an end.

A further question arises with regard to the extension of ossification in the new tissues which form the wall of a bony cavity.

In the specimen from which fig. 1 was taken many points of bone can be seen in the intervening zone between the fibrous tissue and the sclerotic



A B

FIG. 3.—Sections of an actively suppurating ulcer, A, and of a callous ulcer of many years' standing, B, which lay over the deep fascia on the upper aspect of the lower part of the leg. The healthy ulcer is covered with a layer of pus, and is formed of succulent granulation tissue consisting of elongated, multiform fibroblasts, polymorphs and plasma cells, and is abundantly furnished with capillaries disposed (in loops) vertically to the free surface; in the section many segments of the vessels are shown, all of them naturally injected with blood. In the case of the callous ulcer, B, the layer of granulation tissue is notably thinner (less than one millimetre in actual thickness). It consists of a mesh of multiform fibroblasts, only moderately supplied with capillaries, which do not present the vertical disposition of those shown in A. The number of polymorphs in the tissue is markedly less than in A, and there is no layer of pus at the surface. Objective $\frac{2}{3}$.

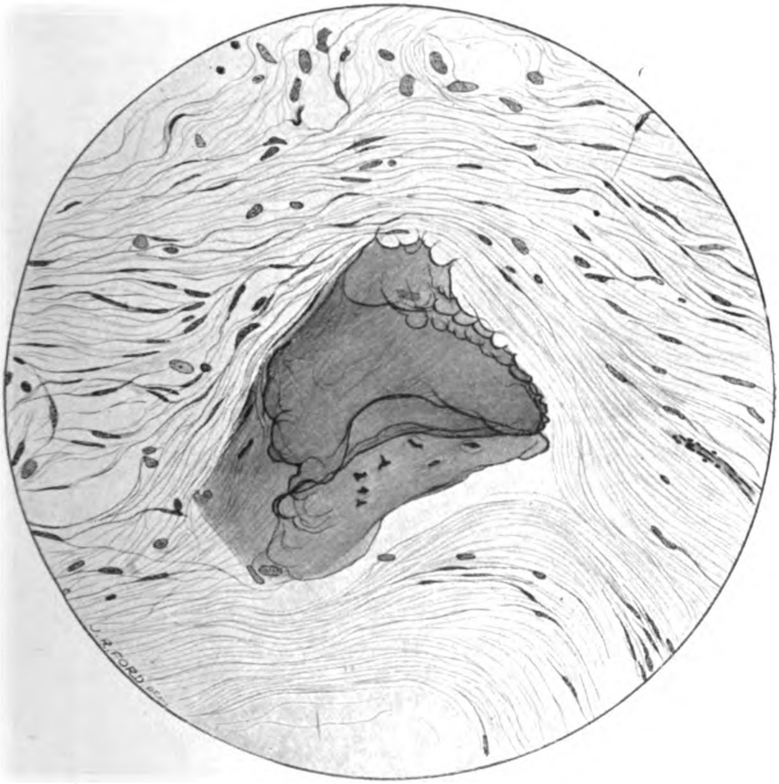


FIG. 4.—From the wall of a long standing cavity in bone; showing a cross section of a trabecula surrounded by fibrous tissue. The trabecula is scalloped from previous absorption; there are no osteoblasts in the contiguous fibrous tissue. $\frac{1}{6}$ objective.

FIG. 5.—No. 516, St. Thomas's Hospital. A fibula of which nearly the entire shaft had been removed after necrosis, the involucrum being widely perforated with cloacæ. In the drawing there is shown one of the cloacæ in the exterior wall of the cavity; through this there is viewed the inner surface of the posterior wall. From the lining of the cavity new bone has been produced in the form of small, upstanding, closely set, convex and curling processes. The whole of the extensive cavity presented a similar appearance. Natural size.

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bone. As we know from the history that the original sequestrum was longer than the cavity which remained, it seems clear that some amount of ossification has occurred in the new-formed tissue. In this connexion the section made by Professor Shattock of another specimen (fig. 4), removed from a two-year-old cavity in a tibia, is interesting. The following is Professor Shattock's report:—

NOTE UPON SPECIMEN OF A SOMEWHAT VOLUMINOUS MASS OF FIBROUS TISSUE PARTLY FILLING A CAVITY IN A BONE.

"In the border from which it was detached, there are a few osseous spicules.

"Microscopic examination after decalcification: The mass consists of well-developed fibrous tissue which varies in density, being in some situations finely fibrillar, and of open texture, with branched connective tissue cells; in other situations containing compact bundles of fibres. The whole of the tissue is moderately furnished with capillaries, capillary arterioles and capillary veins; here and there the arterioles are of a larger grade.

"In one edge there are a certain number of sparsely distributed osseous trabeculæ. In regard to these it is to be noted:—

(1) That in no instances are there any surrounding osteoblasts, the trabeculæ lying in immediate contact with the connective tissue and its appertaining lamellar corpuscles.

(2) The edges of the trabeculæ are deeply and sharply scalloped from absorption, but there are no osteoblasts about these spots or elsewhere, nor is there any excess in the cellularity of the apposed connective tissue: the process of absorption is as much at a standstill as that of new formation.

"In some spots the lacunæ in the immediate vicinity of the scalloped edge are notably enlarged, and in certain of the lacunæ the nuclei of the bone corpuscles cease to stain, showing that the cells have undergone necrosis; the irregularity of the edge in these spots is, in fact, due to this process; but in most places the bone corpuscles in the scalloped edges have normal characters.

"In the neighbourhood of some of the trabeculæ there are groups of fat cells."

Here again the condition of the trabeculæ varies in different cases, for some such cavities present, after maceration, a finely granulated surface indicative of the ingrowth of new bone in the granulation tissue (fig. 5) whilst the interior of others is smooth.

In a section kindly prepared by Captain Greenfield (fig. 6), ossification is shown proceeding in the young connective tissue bounding a chronic suppurating cavity within a bone (shaft of femur), the surface of the space, which is of no great size, being lined with pus.

The problem of filling up these old bone cavities has been attacked in different ways.

(1) In 1886 Schede recommended a procedure based upon the process of "healing by blood-clot."

The cavity left after evacuating the contents and scraping the walls of a tuberculous abscess in a bone, when the operation has been done through unbroken skin, is surgically an aseptic cavity. This heals readily and soundly, being filled with blood that becomes replaced by granulation tissue which, in its turn, becomes organized. Whether there is a limit to the size of a bony cavity which can be thus obliterated it is impossible to say; but if such a limit were exceeded, it is probable, judging from what takes place in the case of large collections of blood elsewhere, that the central part of the cavity would become occupied as a cyst with altered blood.

Schede's method is as follows: An Esmarch's bandage having been applied to the limb, the cavity was prepared with the greatest care so as to render it as clean as possible, and the wound was closed. On removal of the bandage, the cavity would fill with blood which, the wound being relatively aseptic, would become organized into or replaced by fibrous tissue.

(2) Pieces of sponge have been packed into the cavity, in the expectation that such tissue would form a framework for the growth of granulations [2].

(3) Neuber's method [3] consists in laying open the cavity by removal of one of its bony walls, and inverting flaps of skin into the groove so formed. The flaps are secured in position by means of nails.

(4) Senn [4] advocated the use of decalcified bone which had been prepared by soaking in 1 to 500 sublimate alcohol. The cavity, carefully prepared and rendered as aseptic as possible, was to be firmly packed with chips of this decalcified bone.

(5) A method of plugging bone cavities with a paste compounded of iodoform, spermaceti, and oil of sesame, was described by Moorhof and Seymour Jones [5] in 1905. The cavity to be treated was to be cleaned, dried, and filled up with this paste, which was stated gradually to disappear, and to be replaced by bone. Moorhof claimed to have treated 220 cases in this manner without a failure.

Both the last described method and that of Schede demand conditions which must rarely be attainable. "It is an absolute *sine qua non*," wrote Moorhof and Jones, "that the walls of the cavity to be plugged should contain no diseased tissue, and should be perfectly aseptic."

(6) Yet another method of filling the bony cavities is described by Holländer [6]. The cavity is carefully cleansed and prepared, and it is then filled up by pouring melted human fat into it. The fat is obtained at operations from lipomata or omentum; it is freed from connective tissue and melted in a water bath. It is claimed that in some instances healing by first intention occurs, but that in the majority the wound takes about three weeks to heal. It is further stated that the scar, instead of being adherent to the bone and depressed, is freely movable, and flush with the surface.

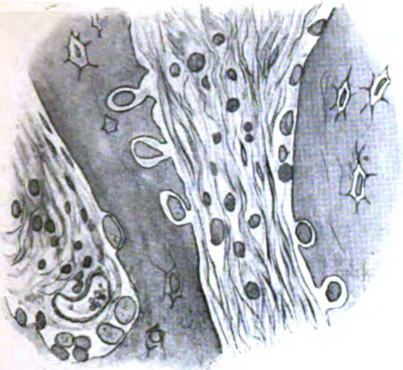

FIG. 6.—From the wall of a small suppurating cavity in a bone; showing the formation of osseous trabecula from the osteogenic connective tissue, by the production of matrix, and the inclusion of the osteoblasts which become bone corpuscles. Gunshot wound of femur, twelve months old; many operations; had never healed. Objective $\frac{1}{6}$.

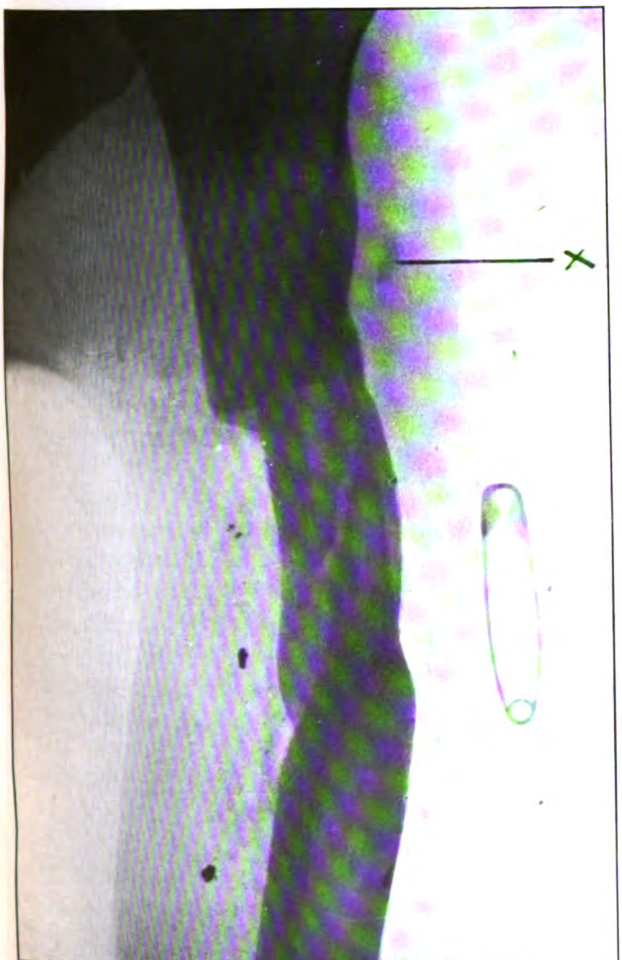

FIG. 7.—A cavity in the humerus after the operation of muscle grafting. To show a chip of bone accidentally left behind.

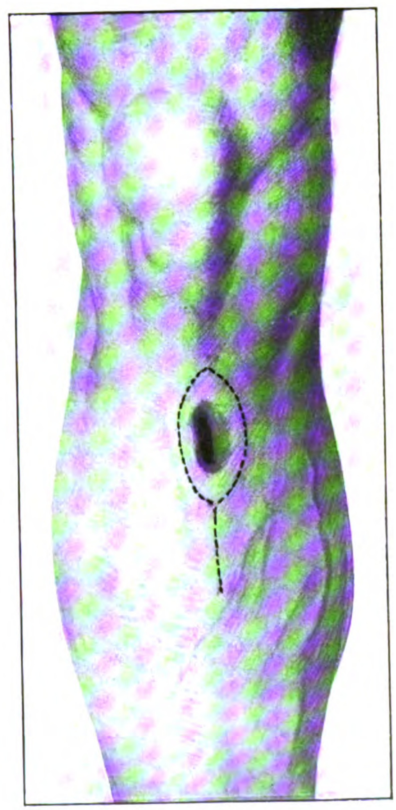

FIG. 8.

To illustrate "The Closure of Cavities in Bone," by Lieutenant-Colonel PERCY SARGENT, D.S.O.

(7) We are indebted to Professor A. Broca [7] for an exposition of the methods which he advocates in the treatment of these chronic bone sinuses, and his book repays careful study. "The persistent sinus," he writes, "is due to the persistence of osteitis and the existence of a suppurating cavity, the obliteration of which should be at least as much the object of operation as the removal of sequestra."

Broca's radical operation aims at the obliteration of the cavity by the falling in of the soft parts. The bone is freely exposed through an incision situated at the most convenient place as regards its anatomical relationships; existing sinuses which lie at a distance from the site of election are ignored. The cavity is converted into an open trough or gutter by the free removal of one of its walls. Any sequestra and all diseased tissue are removed, special care being taken to follow up all recesses and diverticula from the main cavity. The overlying soft parts are then encouraged to sink into and gradually to obliterate the resultant cavity.

The method which I wish to advocate is a modification of Broca's operation, and one which I think in most cases offers certain definite advantages. It may be called that of muscle grafting, to which might be prefixed the term (as Professor Shattock suggested to me) "continuous" —in contradistinction to "discontinuous"—grafting, seeing that the slip of muscle used to fill the cavity is not completely separated, but retains its continuity with the main mass.

Before undertaking the operation, the bone is carefully examined by means of stereoscopic radiograms. The technique of the procedure is as follows:—

No tourniquet is employed. The use of a tourniquet certainly renders certain stages of the operation more easy, but the subsequent oozing is a great drawback. Hæmorrhage is easily kept under control by the frequent application of large pieces of gauze wrung out in very hot saline. As a rule, the operative field can be kept dry by this means. Further, it is easier to judge of the condition of a bone which bleeds under the curette than one which is temporarily deprived of its blood supply. Again, as these operations consume a considerable amount of time, the total deprivation of blood for an hour or more of skin whose nutrition is already impaired by scarring may result in subsequent sloughing.

One of the most essential points in the operation is to secure a sufficiently thorough exposure of bone both above and below the site of the cavity which is to be attacked. The surgeon must see exactly what he is doing in every part of the operative field, and not trust to the curette for discovering hidden recesses.

I usually begin by a fairly wide excision of the wall of the sinus which leads down to the bony cavity. When more than one sinus exists, I select the one which is most conveniently situated, and which gives the easiest and most direct access to the bone, having regard to the anatomy of the

structures in the neighbourhood. Any other sinuses may or may not be dealt with, according to their situation and the density of their walls.

The periosteum is next incised, to the extent of the whole length of the wound, and stripped from the bone so as to bare it completely—not only at the actual site of the cavity, but for some distance both above and below.

At this stage it is convenient to employ Lane's bone levers instead of the ordinary retractors, so as to bring the bone into prominence by depressing the soft parts. They are inserted between the periosteum and the bone.

Before attacking the bone, it is necessary to pack it off by means of gauze pads, partly to prevent soiling of the wound generally, but particularly to prevent fragments of bone getting lost amongst the soft parts and being accidentally left behind (fig. 7.) This is most important: more than one of my own failures was due to the leaving behind of bone chips.

That part of the operation which consists in preparing the cavity for the graft is entirely sub-periosteal.

The bone so exposed can be thoroughly examined, and a decision made as to which wall of the cavity can best be spared from the point of view of strength of the bone. Other things being equal, that aspect of the bone is selected for removal which is most conveniently related to such overlying muscles as can best be employed for filling the cavity.

These points being decided, the cavity in the bone is fully opened up by means of a chisel and mallet, until every part of it can be thoroughly explored. All granulation tissue and dead or carious bone must be removed, and all recesses carefully followed up and cleansed. The cavity is next washed out with hot saline solution, and plugged tightly with gauze. This completes the first stage of the operation.

The second stage is not commenced until all soiled packing has been removed, the towels changed, the instruments re-sterilized, and the surgeon's and assistant's gloves have been changed. From this point onwards, the operation must be regarded as an aseptic procedure. The wound of course is not free from bacteria, but their number has been so reduced that the tissues can deal with the remainder.

Tho actual method of filling the cavity with muscle is different in every case: what one must do is to fashion from the most conveniently situated mass of muscle a thick broad-pedicled flap of approximately the same size as the cavity. It is a plastic operation based upon the same principles as those which govern plastic operations in general, and the main point to be kept in mind is to secure an adequate blood supply to the transplanted muscle. The muscle graft is now pushed into the cavity and pressed home firmly; it readily adheres to the bone. A few stitches of catgut may be required to bring together the overlying muscles and to assist in keeping the graft in position. The skin is loosely sutured and the subsequent escape of exudate is provided for by means of rolls of rubber sheeting inserted in convenient parts of the wound. It is important to place one

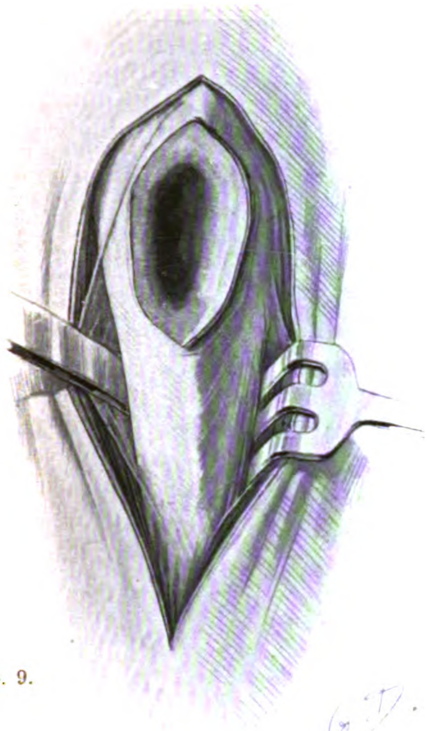

FIG. 9.

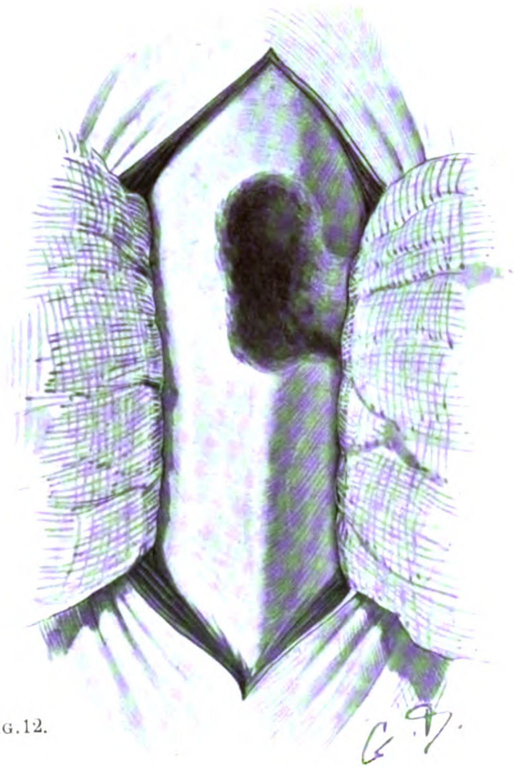

FIG. 12.

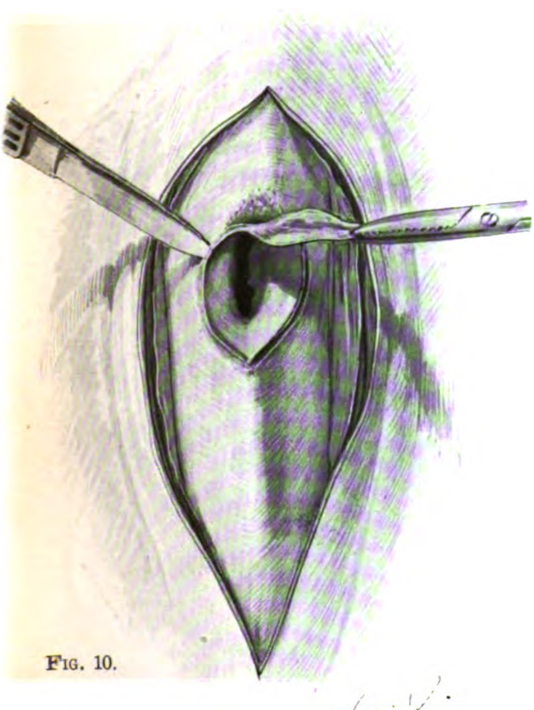

FIG. 10.

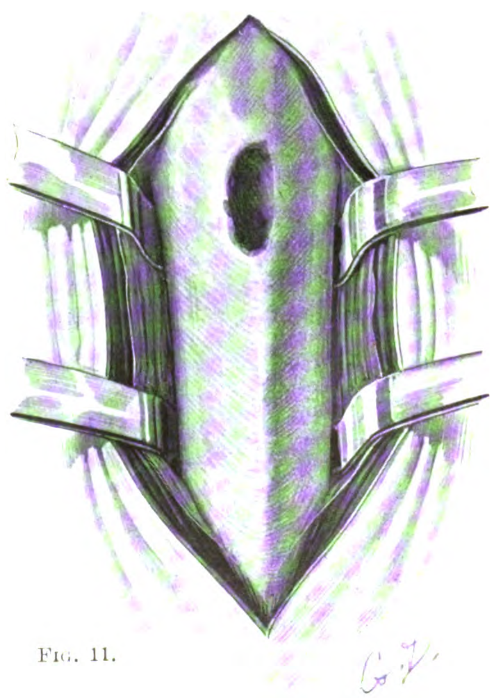

FIG. 11.

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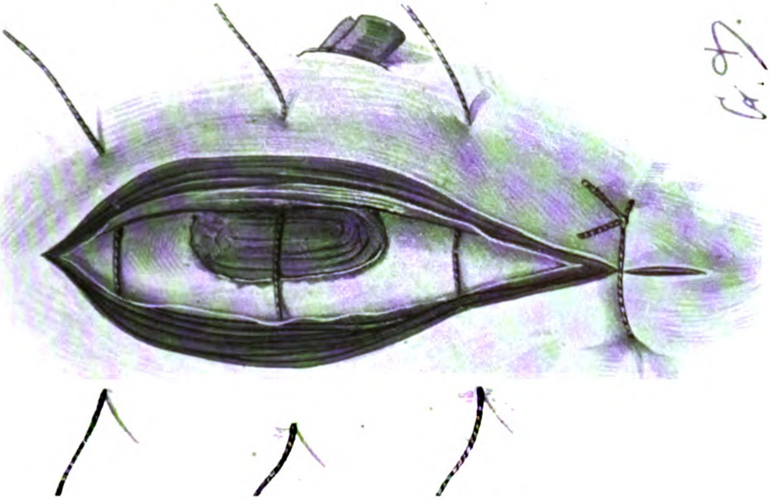

FIG. 15.

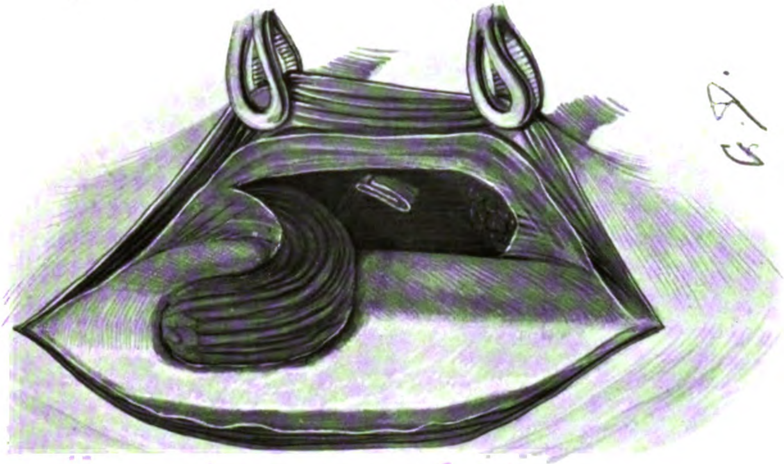

FIG. 14.

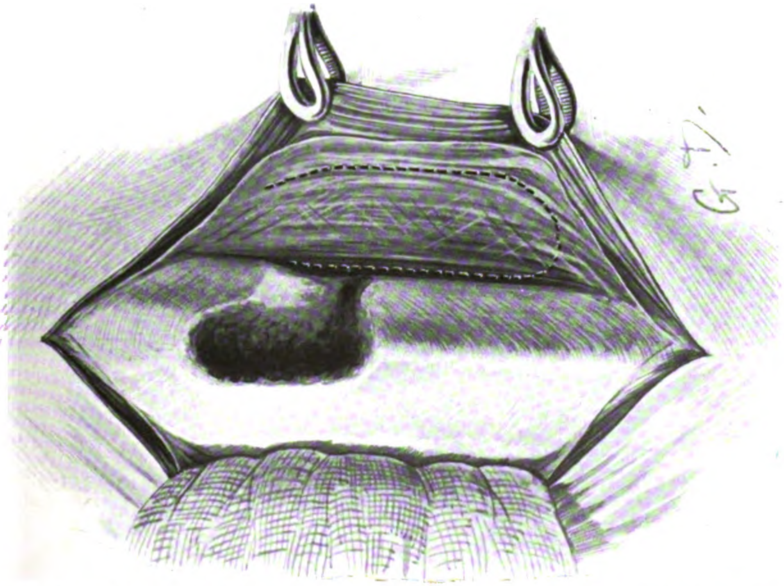

FIG. 13.

To illustrate "The Closure of Cavities in Bone," by Lieutenant-Colonel PERCY SARGENT, D.S.O.

such drain in the space from which the muscle graft had been cut, as was pointed out to me by Captain Z. Mennell, who has had a large experience of the operation. These drains are usually removed at the end of forty-eight hours. The limb is splinted in such a way as to relax the parent muscle (figs. 8 to 16).

In some cases these wounds have healed practically by first intention, but there is often a considerable reaction, which may last for several days, the temperature being raised to 101° F. or higher, and the wound discharging a quantity of exudate, which is sometimes thin and watery, and sometimes frankly purulent. In one or two instances severe suppuration has occurred; the wounds have, nevertheless, eventually healed soundly.

One advantage of the muscle graft over the method of Broca is that less bone need be removed: it is not necessary to convert the whole cavity into an open gutter. Hence the bone need not be weakened to the same extent (Broca speaks of fractures having occurred during his operation). Further, the cavity often extends into the articular end of a bone, in which case it cannot be converted into an open trough in its whole extent. The obliteration of the cavity by the falling in, or pressing in, of the overlying soft parts may take some time, and may fail to be complete; by means of muscle grafting we get an immediate and entire filling up of the space. In contrast with the other materials which have been used, we have in muscle a living vascular tissue, which may be presumed to furnish cells and fluids capable of completing the removal of such micro-organisms as may remain.

What takes place during the process of healing? It is possible that, in parts at least, union between the raw bone and raw muscle may occur by first intention; or, if this fail, the bone and muscle may each become covered with granulations which subsequently unite. In either case, the respective blood-vessels of bone and muscle coalesce, so that an additional supply of blood is brought to the bone.

As to the ultimate fate of the muscle graft, we can but speculate. So far, we have no evidence that bone formation occurs; indeed, ossification in the graft would be difficult to demonstrate radiographically, when it is borne in mind that the dimensions of the empty cavity itself, owing to the density of its walls, can only approximately be determined by this means.

The condition under which ossification takes place in striated muscle is that of chronic inflammation, and an extension of bone into the graft might conceivably occur should the parts concerned be not strictly aseptic, and the graft become the seat of a chronic myositis.

The graft retains its connexion with the parent muscle, and may take with it a nerve supply, in part at least; it need not cease to functionate if the arrangement were such as merely to make the transplanted slip arise from, or shift its insertion into, another part of the bone. A specimen in the Museum of the Royal College of Surgeons (422.1) suggests that displaced muscle will retain at least a recognizable muscular structure. The description is as follows:—

"A right femur which has been fractured obliquely below the middle. The fragments, which have undergone but little displacement, are united by a long hollow cylindrical formation of callus, the remarkable form of which is due to the inclusion of a portion of muscle between them. In the channel, which is lined, like the rest of the callus, with compact tissue, the muscle, or its remains, lay when the patient died."

The fate of the graft, however, is a matter of subsidiary importance; for if the procedure has successfully obliterated the cavity, its real object has been attained, namely, sound and final healing. Whether ossification ultimately takes place is immaterial from the point of view of strength, for, as the patient uses the limb, and so subjects the bone to strains and stresses, compensatory overgrowth occurs. This is well exemplified in fig. 17, a radiogram taken by Captain Keen.

My best thanks are due to Professor Shattock for much valuable help and criticism.

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[6] HOLLÄNDER. *Centralbl. f. Chir.*, 1918.
[7] BROCA, A. "Les Séquelles Ostéo-articulaires des Plaies de Guerre," 1916.

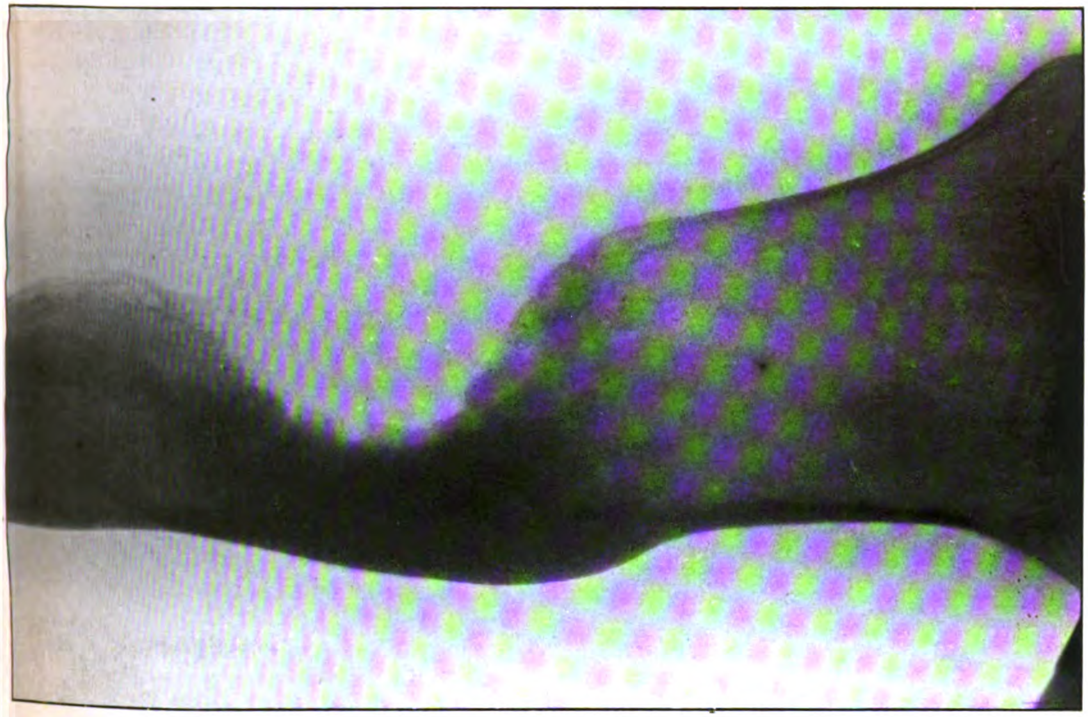

Fig. 17.

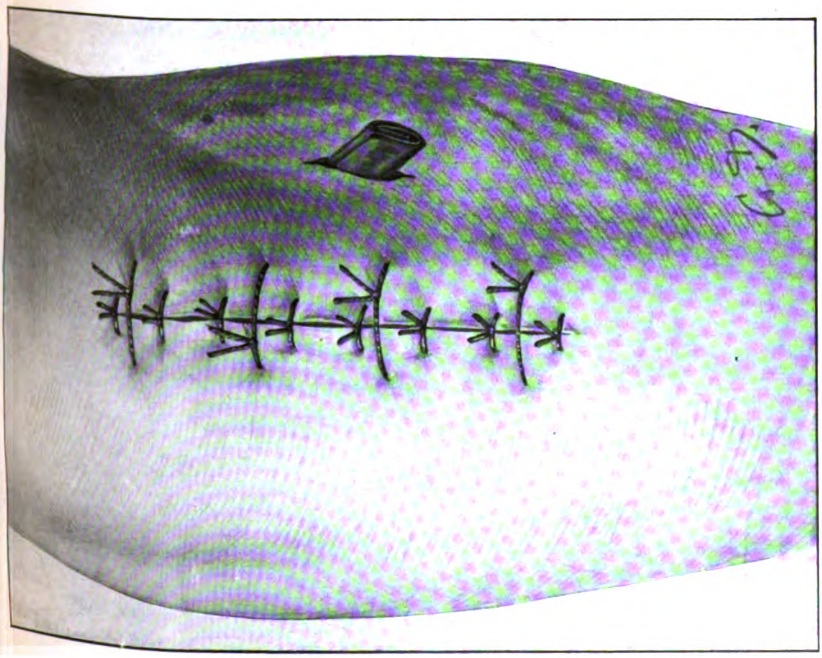

Fig. 16.

Fig. 17.—A femur after a radical operation by Capt. R. White, showing compensatory overgrowth or sclerosis in the bone bounding the cavity. The patient had walked on the limb, in a caliper splint, for nearly a year after the operation.

To illustrate "The Closure of Cavities in Bone," by Lieutenant-Colonel Percy Sargent, D.S.O.

A HISTORICAL INQUIRY INTO THE EFFICACY OF LIME-JUICE FOR THE PREVENTION AND CURE OF SCURVY.[1]

By ALICE HENDERSON SMITH.
(*From the Lister Institute.*)

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I.—Introduction.

The antiscorbutic value of fruit juices was recognized three hundred and more years ago, and the traditional faith in lime juice as a specific remedy and preventive for scurvy is of very old standing. During the wars of the second half of the eighteenth century, this belief was so constantly and so powerfully confirmed that in spite of the great expense and difficulties entailed, a regular supply was eventually adopted by the British Admiralty; and early in the nineteenth century the disease, hitherto a most serious menace to the efficiency of the Navy, was practically eliminated by the introduction of a general issue of so-called "lime juice."

The firm belief in lime juice is not, however, shared by those who in recent years have had occasion to put its value to a practical test. Dis-

[1] A short abstract of the results contained in this paper was published in the *Lancet*, November 30, 1918.

appointment in its antiscorbutic powers may be traced in the reports of Arctic explorers towards the end of the nineteenth century. During the present war, lime juice prepared from the West Indian sour lime has been issued to troops when the military circumstances rendered an adequate supply of fresh meat and vegetables impossible, and the opinion formed of it by medical officers who have been confronted with outbreaks of scurvy among the troops appears to be equally unfavourable.

An experimental study of scurvy has recently been carried out by a group of workers at the Lister Institute.[1] These researches have largely been devoted to an experimental determination of the relative antiscorbutic value of different foodstuffs, and among these considerable attention has been paid to fresh and preserved fruit juices. The fresh juices of oranges and lemons were found to be among the most potently antiscorbutic of the materials examined; that of the fresh, ripe lime was discovered to be markedly inferior to that of the lemon, and preserved lime juice, as issued to the Services, was found to be useless for the prevention of scurvy by the method employed.[2]

The following historical investigation was undertaken in the hope that light might be thrown upon the divergence between the Naval experience of a century ago on the one hand, and the recent experience with outbreaks of scurvy in man and experiments upon animals on the other. The explanation that has emerged is both satisfactory and simple. It has appeared that the introduction of the juice of the West Indian lime as the lime juice ration in the Navy and Mercantile Marine dates only from the latter half of the nineteenth century, when the faster rate of travel, among other changes, caused a great improvement in the dietary on board ship, and any serious reliance upon the antiscorbutic value of the lime juice carried would be an extremely rare occurrence. In the early part of the nineteenth century, when the lime juice ration often provided the only antiscorbutic food in the sailors' dietary, it was the juice of lemons from the Mediterranean that was employed.

The contrast in the value of these two products is dramatically shown in the experience of two Arctic expeditions, provided respectively with the juice of lemons and of limes, of which a full description is given in the following pages. In other respects the circumstances seem to have been comparable. The "Investigator," commanded by McClure, which went in search of Sir John Franklin, 1850 to 1854, was supplied with lemon juice and enjoyed immunity from scurvy for over two years, notwithstanding great privations. The "Alert" and "Discovery," in 1875, were the first ships on Arctic service to which the preserved juice of West Indian limes was issued. To the dismay of all concerned, severe scurvy broke out after

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[1] Chick and Hume. 1917. *Trans. Soc. of Tropical Medicine and Hygiene*, vol. x, p. 141.

[2] Chick, Hume and Skelton. 1918. *Lancet*, November 30, 1918.

the first winter spent in the Arctic circle. The Admiralty Committee appointed in 1876 to inquire into the cause of this outbreak found no satisfactory explanation. It took no cognizance of the change in the nature of the lime juice provided. In the light of the experimental researches mentioned above, this substitution of limes for lemons in the preparation of lime juice appears to have been the cause of the disaster.

II.—What Lime Juice Was and Is.

". . . The juyce of Lemmons is a precious medicine and well tried, being sound and good, let it have the chiefe place, for it will deserve it, the use whereof is: It is to be taken each morning two or three spoonfulls, and fast after it two houres, and if you add one spoonfull of Aquavitae thereto to a cold stomack, it is the better. Also if you take a little thereof at night it is good to mix therewith some sugar, or to take the syrup thereof is not amisse. . . . *In want whereof*, use the juyce of Limes, Oranges or Citrons, or the pulpe of Tamarinds." So, in his chapter on scurvy, Dr. John Woodall, a surgeon of the East India Company, in "The Surgeon's Mate," which was published in 1617. The knowledge of this precious medicine was not new in his day, and he knew almost as much of the use of it as we do to-day. And in his day there was "a good quantitie of the juyce of Lemmons sent in each ship out of England by the great care of the Marchants, and intended onely for the relief of every poore man in his neede, which is an admirable comfort to poore men in that disease." But the knowledge of it did not grow as the need for it grew and multiplied; and the merchants, with the growth and complication of their affairs and the continual increase of shipping, failed in this personal great care of the seamen carrying their merchandise; and invention failed to meet the problem of the preserving of a fresh fruit on long voyages. A century and a half later, Dr. Lind became the authority of his day on scurvy, and made a great step forward by his attempt to solve that problem. But when in the second half of the eighteenth century England was involved in war after war, scurvy was still unconquered and its ravages were such as seriously to menace the efficiency of the Navy and thus the safety of the country. Many remedies were tried, more or less ineffective, before the juice of lemons, limes and oranges, proved to be useful by generations of merchant sailors, was adopted and its preparation and issue begun on a large scale.

Recent investigation[1] having thrown doubt on the efficacy as an antiscorbutic of the lime juice now issued to the Services, it has become desirable to seek in history for any information as to the qualities, the source and preparation of the "lime juice" that was used when its reputation was made in the Navy. The examination of the Admiralty records with

[1] Chick and Hume. 1917. *Trans. Soc. Tropical Medicine and Hygiene*, x, 141.

this object has been disappointing, large series of records having been destroyed, including the medical records; and of those that remain many are chaotic masses, unordered, unindexed, undigested, so that a search for details so remote is laborious and its harvest small. Exact information is the more difficult to obtain because in the early days of the use in the Navy of the citronaceous fruits, there was practically no discrimination between *limes* and *lemons*. Again and again the terms "lemon juice" and "lime juice" are used indifferently in the same letter, of the same consignment; either term was applied indiscriminately to the juice of limes and lemons, and the confusion remains to-day. Limes and lemons were taken to be to all intents and purposes the same thing, and the only occasion on which I have found them definitely differentiated in the correspondence of the Sick and Wounded Board, during the time when scurvy was a pressing problem, is in a question of the number of fruits required in the treatment of cases, and so is a reference only to the difference of size between the two fruits.

The two words both derive from a word that takes different forms in different parts of the far East, *lemon, limoo, lemo*, etc., but stands for the whole genus Citrus.[1] The two fruits were differently named in England early, but before the lime was familiar the lemon was called lymon, and later limon and limmon. From the same origin the French derive *limon* and *limonier* (*Citrus limonum*, Risso; our lemon and lemon-tree), but except in the south they use *citron* for the lemon (an irregularity deprecated by Risso who refuses to conform with it), and *limonade* and *jus de citron* represent equally and interchangeably our lime juice and lemon juice, which does not tend to relieve the confusion. Thus in the records—

"The Lemon and the piercing Lime
Their lighter glories blend,"

making it a matter of difficulty to divide and consider their relative virtues or to recognize what fruit exactly was used for the health of the Navy, until one turns to the source of supplies. There at least, in correspondence in connexion with the actual purchase of the fruit, one may expect to find more exact terminology, and from its source to learn what the fruit was.

According to the authorities, Linnæus, Risso,[2] &c., *Citrus medica*, includes all citrons, lemons and limes. Risso, in his exhaustive catalogue of the oranges of Europe, calls the lemon *C. limonum*, and gives the varieties *C. limonum vulgaris* and *C. limonum bignetta* as the two most cultivated on the shores of the Mediterranean. They are the lemons of our daily use. It is the *C. limonum* that is grown exclusively for commercial purposes in the south of Italy. *C. limetta* is the *lime* of the south of Europe and was cultivated some centuries ago in the south of France much more than in Risso's time or since. *C. limetta hispanica* is a variety

[1] "Cultivated Oranges and Lemons of India." E. Bonavia, M.D., I.M.S., 1888.

[2] "L'histoire Naturelle des Orangers de l'Europe," Risso et Poiteau. 1818. Second Edition, 1873.

grown in Spain from remote times, but the lemon is the more important product there too. In his "Reflections on the Commerce of the Mediterranean,"[1] 1804, a book that gained the attention and respect of the Admiralty, Jackson does not mention the lime at all, among the exports, but he gives lemons, oranges, lemon juice and the essences of lemon and bergamot in his list of Sicily's important products. The *C. limetta* is a sweet lime, its juice being but slightly acid; it is hardly distinguishable from *C. lumia* which is also called sweet lime or sweet lemon, and it is akin to the sweet limes of India.

The sour lime is quite another variety.[2] It is the *C. medica*, var. *acida*, and does not occur in Risso's list of the European varieties. Like all the genus Citrus it came from the East Indies, but it was very long ago taken by European colonists to the West Indies, and since the middle of the last century its cultivation there has become a very large industry. It is *C. medica acida* from which our modern lime juice is procured.

We know, then, that limes from the Mediterranean were *sweet limes* only and we know that the Italian fruit was *lemons* only. The West Indian lime is the *sour lime*, which demands different conditions of climate for its growth.

It is not by any means easy to find the source of the fruit at first used by the Admiralty, as all the contracts of the Sick and Wounded Board have been destroyed, and at first it was the Sick and Wounded Board that bought and issued the juice. From information available in scraps in departmental correspondence, however, it appears that the juice that was used did come from the Mediterranean. For years there was great difficulty in getting enough. The Sick and Wounded Board periodically recommended the extension of its use, to which the Lords Commissioners replied that such was their intention, that they were only waiting for the Sick and Wounded Board whose business it was to find the supply. In 1796 Spain changed over to the French side in the war, thereby reducing the available sources of the fruit and so raising the price. Deficiencies were made up to a certain extent with lemons from Lisbon, but it was then hoped to get lime juice cheap from the West Indies and inquiries were sent to the victualling agent and to the Commander-in-Chief on the Jamaica station. Reports were received but have not been preserved, and presumably they must have been unfavourable as there is no reference to any supplies coming thence. When, after the Battle of the Nile in 1798, Nelson took possession of Malta, we had in our own control an ample source of supplies of lemon juice, but it is not until September, 1803, that we find the first attempt to get a supply from Malta. The Commander-in-Chief on the Mediterranean, Lord Nelson, was asked to inquire into the possibility of doing so, and the resulting report was so favourable that contracts were immediately formed. (The price quoted for the fruit juice

[1] "Reflections on the Commerce of the Mediterranean." John Jackson, F.S.A. 1804.

[2] "The Sour Lime," *Botanical Magazine*, tab. 6745. Sir J. D. Hooker.

was 1s. per gallon, while the London contractors who had supplied the Admiralty from 1794, tendered at the same time a quantity at "8s. per gallon, or, in the event of war with Spain, 9s. per gallon." Presumably freight was very high then, owing to war risks, as it is now.)

It is possible, then, that the "lime juice" issued before 1804 had in it at least a proportion of the juice of sweet limes as well as of lemons. After that the whole supply until 1860 at least (with the exception of that for the West India squadron from 1846, to which reference is made later) was contracted for at Malta and consisted of the juice of lemons grown in Malta and Sicily. This Malta lemon juice was used for all our ships, and sent not only to Halifax and the Baltic, but to the Cape of Good Hope and to the West Indies, and even the Gibraltar station was supplied from Malta.

III.—Indications that Lemon Juice ("Lime Juice") was Responsible for the Disappearance of Scurvy from the Navy at the Beginning of the Nineteenth Century.

One fact that emerges clear from the Admiralty correspondence is that the regular issue of lemon juice was achieved not all at once, but only gradually over a number of years. In his much-quoted statement, made in the year 1830, that the use of lemon juice in the Navy was begun in 1795, and scurvy "totallv rooted out" within two years, Sir Gilbert Blane [1] was swayed by an optimistic enthusiasm, after the work had been accomplished and found to be good.

There was no regular and general issue of lemon juice in the Navy in 1795. Indeed lemon juice was practically one of the things for which the sailors mutinied in 1797. Among the very modest demands drawn up by the companies of fifteen ships in mutiny in April of that year, one was: "That your Lordships will be pleased to look into the state of the sick. . . . that their necessaries be not on any account embezzled." Another, "That there may be granted a sufficient quantity of vegetables of such kinds as may be most plentiful in the ports to which we go; which we grievously complain and lay under want of." And an interesting letter [2] of Admiral Waldegrave shows that the seamen knew the value of lemon juice and resented its not being supplied to them. In November, 1897, the Admiral had requested that he might have expenses allowed from last May, for vegetables and lemon juice he had bought, which their Lordships refused, and he appealed again:—

"London, *December* 2, 1797.

"Evan Nepean, Esq.,

"Sir,—In answer to your letter of 24th ultimo, stating that the Lords Commissioners of the Admiralty conceive it might have been proper for me to have

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[1] "A Brief Statement of the Progressive Improvement in the Health of the Royal Navy," Sir Gilbert Blane, 1830, p. 13.

[2] Pub. Rec. Off., Adm. Sec.'s In-letters.

ordered a supply of lemon juice to H.M.S. 'Pluto' from the time of my receiving the application to that effect, but that they cannot allow of its bearing a retrospect, and will not admit of any charge of that description being brought against the Public, I have to request that their Lordships will be pleased to take into consideration the temper of the times and my own peculiar delicate situation, which not only required of me the nicest judgment to preserve my squadron from breaking out into a determined open mutiny, but also demanded no less management and circumspection to prevent the mutineers from increasing the apparent discontent of the troops and forming a junction with them.

"In this critical situation the 'Pluto's' ship's company applied to me for lemon juice and sugar, the same as had been issued to the 'Latona' and 'Romney,' demanding that the allowance might take place from the time it had been first issued to the latter ship. In this dilemma, being but too sensible how little command I had over the seamen of the squadron, and being apprehensive that I should receive no real support from the troops, I determined to make a virtue of necessity and comply with their request. Were it necessary to call witnesses on the occasion, I could prove that this very measure kept the crew of the 'Pluto' from joining in the mutinous proceedings of the 'Latona,' which had it once taken place, I am certain the troops would have joined in the league, the 'Pluto's' people from their long residence in this country being closely connected with the whole of them. . . .

"(signed) WILLIAM WALDEGRAVE."

There is a marginal note on this letter, which may be in Sir Gilbert Blane's own handwriting as he was then one of the Commissioners of the Sick and Wounded Board. "December 4: Let me see whether he received the second order about *confining the use of lemon juice and sugar to those only on the surgeon's list.*"

Even in 1801, it was only after some correspondence with the Sick and Wounded Board, of which Sir Gilbert Blane was still a member, and after overcoming obstruction, that Dr. Baird, surgeon on board Lord St. Vincent's flagship, got that full issue of lemon juice to the Fleet during the siege of Brest that secured for it the exceptional record of health triumphantly cited by Sir Gilbert Blane. It was only in August, 1804, that the representations of Dr. Baird to the Lords Commissioners achieved the order that lemon juice and sugar should be issued regularly to the Channel Fleet. Before that it was given only to ships going on foreign service and for the use of the sick.

And so far from scurvy having been stamped out within two years of 1795, thousands of cases continued to occur well into the next century. That they ceased to occur in large numbers in the records of the naval hospitals was due to the fact that in the new sick bay and with the improved knowledge and more uniform treatment of the disease, it was found to be as easily curable on boardship as on shore. Indeed, the swing of *that* pendulum is shown by the statement of Dr. William Turnbull,[1] in 1806, that it could not be so well cured on land as at sea.

[1] "The Naval Surgeon, Comprising the entire duties of Professional men at Sea." William Turnbull, A.M., 1806.

There is no question, however, of the very great value of lemon juice, as demonstrated by the history of individual ships in this period. Where no lemon juice was issued scurvy raged, and when lemon juice or lemons and oranges were supplied, the scurvy was immediately abated or cured. That is a commonplace. But the question of the exact share taken by this important issue in the general very gradual improvement in the conditions of the seamen is complicated by its introduction coinciding with many other changes of enormous importance to the health of the Navy. Apart from the fact that before 1797, owing to the dishonesty of pursers and surgeons, medicines and comforts very often failed to reach the sick men for whom they were issued, the adoption of the issue of lemon juice concurred with the introduction and increasing use of vegetables in the seamen's diet, due to the efforts of Dr. Trotter; with very much improved issues of fresh meat; with more uniform and more considerate treatment of the sick and ailing; with great improvements in the men's quarters; and with the copperplating of ships, making them cleaner and therefore faster, as well as drier. The study of these changes is full of interest, but for the immediate purpose of comparing lemon juice and lime juice it is more useful to go forward to the middle of the nineteenth century and look for any information that may be gleaned round about the time when the change was made by the Admiralty from the one fruit to the other.

During the first half of the century evidence continued to accumulate in favour of "lime juice"—that is, the juice from the Mediterranean. When practically extinct in the Navy, scurvy flourished in the Mercantile Marine, especially in ships sailing to and from the east, and was reduced when the use of "lime or lemon juice" was made compulsory by the Act of 1844;[1] and, again, when the Act of 1867[2] doubled the compulsory issue ($\frac{1}{2}$ ounce increased to one ounce daily), and secured that the juice supplied should reach a certain standard of quality, there was a significant drop in the number of cases received into the Seamen's Hospital.[3]

Measures taken to ensure a Pure and Unadulterated Supply of Lemon Juice.

The purity of the supply for the Navy was always a matter of much care and concern, and there was difficulty, and sometimes failure, in securing it from adulteration. As was natural, injured or decayed fruit that was not fit to be shipped was made into "lime juice,"[4] and in 1853 we

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[1] 7 and 8 Vict. Cap. 112, S. 18, by which the master of every ship must supply lime or lemon juice or other such articles as the Board of Trade may sanction as substitutes, and sugar and vinegar, whenever the crew have consumed salt provisions for ten days; $\frac{1}{2}$ ounce each daily of juice and sugar, and one pint of vinegar weekly.

[2] Merchant Shipping Amendment Act, 1867.

[3] Wm. Johnson Smith, F.R.C.S., Seamen's Hospital, Greenwich, in *Practitioner*, 1896, vol. lvi, p. 579, and *Lancet*, August 15, 1891.

[4] Jackson, "Commerce of the Mediterranean," 1804.

find the statement without comment in a medical work,[1] "Lemon juice has long been regarded as an invaluable antiscorbutic; but, on account of the difficulty of preserving it, crystallized citric acid is usually substituted." From about 1838 complaints were made repeatedly about the quality of the lemon juice being supplied from Malta, but severe therapeutic tests were not then occurring in the ordinary service of the Navy, as the ships were seldom exposed to scurvy conditions. Polar exploration, however, offered opportunities for testing it, and Sir James Ross's expedition of 1848 returned in 1849 with a report of a serious outbreak. The lemon juice supplied to his ships was examined and was found to lack nine parts in ten of the proper acid content. The grave importance of the matter was at once apparent, and Sir William Burnett, Medical Director General, began an exhaustive inquiry. All lemon juice in the victualling stores was analysed, with results showing that all was below the proper standard of acidity, although none of the reports showed so large a deficit as that of the juice brought home by the expedition. The method of preparation was reported on in great detail, and opinions obtained from several chemists as to the point at which it had failed. It appears from these reports that nothing was lacking of care and precision from the moment at which it was delivered to the Naval representatives by the contractors. But the fruit was being gathered in summer, instead of in the first months of the year, when its acid content is greatest, and there was no guarantee that the fruit used was sound. Moreover, the juice was allowed to settle for a month, to clear it, before it was tested for acidity, after which the preservative agent was added, so that, the chemists said, fermentation had probably often begun before the addition of the spirit. And we know now that in that time it had lost considerable antiscorbutic potency. It has to be remembered that lemon juice was a bye-product for the contractors, their principal business being concerned with the rind of the fruit in the preparation of essential oils and crystallized peel. The unsatisfactory standard, or want of standard, of cleanliness, too, of the native workers demanded new clauses and safeguards in later contracts. From that time an officer was sent from Malta to Messina, or wherever juice was bought, to superintend its production in the interests of the Service. To be perfectly sure in the meantime that the other Arctic explorers who were about to leave England should have the best possible, the Medical Director General caused fresh lemons to be bought, and juice to be prepared specially for them at Deptford. He thus secured for them a supply much better than any that was then to be bought in the open market, and the ships furnished with it enjoyed a remarkable immunity from scurvy.

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[1] Pereira, *Materia Medica*, Third Edition, 1853, p. 1999.

IV.—Introduction of Lime Juice prepared from the West Indian Sour Lime.

The supply of reliable "lime juice" was still not equal to the need when the industry of its production was started in the West Indies by Messrs. Edmund Sturge, citric acid manufacturers of Birmingham, who undertook it, at first on a small scale, when they bought land for the purpose in Montserrat in the early fifties. Lime juice from the West Indies had been tried with a view to its use in the Navy, ou the suggestion of the Governor of Bermuda, in 1845. Sir William Burnett, taking up any idea that might lead to the improvement of supplies, caused samples from Bermuda to be tested and compared with Malta samples. The report of the Bermuda juice was so favourable that although its cost was rather more, an order was given in 1846 that H.M. ships stationed there should be supplied with this, the produce of the colony. Eventually, in the sixties, the Admiralty arranged contracts for the whole of its supply of lime juice from the West Indies. This it was enabled to do by the development of the cultivation of the lime in Montserrat, where the production was managed in such a way as to secure the fruit being collected uniformly at the stage of its growth when it is of most value, and to secure also the utmost possible purity of the juice as prepared for use. It was considered very superior to the old supply, was probably much cleaner and stronger in acid, and the Merchant Service adopted it, too, as far as it was available.

The tests of quality were always chemical of course, not therapeutic, and consisted principally in ascertaining the amount of alkali that was neutralized by a given amount of juice. As a matter of fact, it was a mistake to suppose that acidity was necessarily the important element. Pure citric acid was known a hundred years ago to compare unfavourably with the fruit juice in the treatment of scurvy, and yet, by another confusing eccentricity, the surgeons then often spoke of their fresh lemon juice as "citric acid"; it was still supposed that it was the combination of the acids in it that was important. Recently the protective value of lemon juice from which all the citric acid has been extracted, has been tested experimentally, and it has been found to be unimpaired;[1] so that mere alkali tests, although useful as a check on the purity of supplies, were really no just measure of the antiscorbutic potency.

In the meantime a new and momentous change of conditions comes in with the beginning and development of steam navigation. With steam power, voyages were so shortened that ships' companies were never for many weeks cut off from fresh supplies, so at a stride lime juice was enormously relieved of its responsibility, and tests of its merit thus became fewer. Still, however, the history of Polar exploration gives an opportunity for studying the incidence of disease in definite relation to the

[1] Harden and Zilva, 1918. *Biochemical Journal*, vol. xii, pp. 259.

various prophylactics. There we get exact statements of the amounts and kinds of food used, and should be able to make some estimate of the value of different rations. Before 1860 all the juice issued by the Admiralty was the juice of *lemons* from Malta, and it is interesting to compare the experience of Arctic explorers immediately before that date with that of the expedition of 1875, the first that was supplied with the juice of *limes* from Montserrat. In other essentials their conditions were very similar. In that point they differed. Does that difference possibly supply a key to a question hitherto unanswered, the cause of the great contrast in their experiences of scurvy?

V.—(i) Experience from two Arctic Expeditions provided with Lemon Juice and Lime Juice respectively.

When Sir John Franklin sailed with the "Erebus" and the "Terror" in 1845 the problem of a North-West passage to the Indies and Cathay to which so much energy and attention had been devoted by generations of merchants, geographers and sailors, seemed to be very near a solution, but gave precedence, on his failure to return in 1847, to the urgent question of his safety. Then began a series of search expeditions following one another closely, until Franklin's fate was finally ascertained beyond doubt by Sir L. McClintock in 1859. Of the many vessels that took part in the search, a number left England in 1850, and I propose to compare the voyage of one of these in particular, the "Investigator," with the 1875 expedition of Nares on the "Alert" and the "Discovery," because we know that the fruit juice was used in precisely the same manner, with the same safeguards against any variation in the consumption of it, in the two cases.

In 1850, the "Enterprize," Captain Collinson, and the "Investigator," Captain McClure, went round by way of Behring Strait, while Captain Austin's four ships, "Assistance," "Resolute," "Pioneer" and "Intrepid," followed Franklin's route by Barrow Sound. Of the eastern ships, Collinson's, having searched a great part of the coast of America, got home in 1854, and McClure and his companions in the "Investigator" were the first men who actually traversed the North West passage, although the second part of their journey in 1854 was made in a relief ship, the "Investigator" having had to be abandoned, icebound, in 1853. All these ships, although equipped with the utmost care and given all that science or experience demanded as desirable and practicable for the preservation of health, lived necessarily very near the scurvy line, and most of them had more or less experience of scurvy. But in no case did it threaten the efficiency of the ship's crew even after a second winter in the ice, and cases did not often occur before the second winter.

The "Investigator's" crew had the longest term of all in polar seas. Of their experience there is a closely detailed account published in 1858,

by the Medical Officer, Dr. Armstrong,[1] from the point of view of scurvy solely. His ship's company had a longer period of immunity from scurvy than any previous party engaged on polar exploration, and this immunity Dr. Armstrong attributes solely to the rigid regularity of the issue of good lemon juice. The ship left England in January, 1850, and the first case of scurvy did not develop until the spring of 1852, twenty-seven months after leaving home, and seven months after the principal rations had had to be reduced to two-thirds of the quantities originally thought requisite.

The voyage out, which occupied six months, took the ship twice through the tropics and round Cape Horn. During these six months they had only, of fresh provisions, in the Strait of Magellan, two small bullocks giving a few day's fresh meat, and no vegetables; at the Sandwich Islands, fresh meat for fourteen days and a quantity of vegetables of which the different accounts vary from the "less than fourteen days' supply" of Dr. Armstrong's[1] account to "forty days' supply" of Captain Sherard Osborn's.[2] That it was enough to be of definite value is shown by Captain McClure's letter to the Admiralty written immediately afterwards. "It gives me great pleasure to say that the good effects of the fruit and vegetables (a large quantity of which we took on board at Oahu) are very perceptible in the increased vigour of the men, who at this moment are in as excellent condition as it is possible to desire, and evince a spirit of confidence and a cheerfulness of disposition which are beyond all appreciation." But it was certainly less than they hoped for, for the visit of the "Enterprize" to the port, just before them, and the annual visit of the American whaling fleet on their way north, had much reduced the resources immediately available.

The ship met with bad weather, being twice dismasted by the violence of the gales, and the conditions for the crew were very arduous; she became leaky and the lower deck was damp and ill-ventilated from the frequent necessity of battening down the hatches. And the air on board continued to be so damp and so impure from there being insufficient fuel to dry and warm it, that cases of ague occurred each winter. Thus the crew did not have a specially favourable preparation for their first winter in the ice, nor did they have specially favourable conditions during their long imprisonment, which lasted for three and a half years before they left their ship. In that whole time there were three deaths from scurvy out of a ship's complement of sixty-five.

As, in 1820, Parry had sighted Banks Land from Melville Island, but had been unable to reach it because of the miles of impenetrable ice of Melville Sound intervening, so in his first autumn McClure sighted Parry's farthest on Melville Island and knew that only those seventy miles of ice lay between him and the making of a North-West passage.

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[1] "Naval Hygiene and Scurvy." Alex. Armstrong, M.D., R.N. 1858.
[2] "McClure's Discovery of a North-West Passage." Sherard Osborn.

He was then drifting fixed in the ice at the north end of Prince of Wales Strait. The current carried him south and he wintered in the Strait, 1850-51. He tried again the next year but found it impossible to get his ship through the ice and so took her south to make another attempt from the western side of Banks Land. He was beset in the ice and had to spend a second winter, 1851-52, in a bay on the north of the island, which he called the Bay of Mercy. He never got his ship out again. He crossed Melville Sound with sledges, expecting to find one of Austin's ships, but all he found was the record of their visit a year before. He left a record on the same stone as Parry's, and returned to spend a third winter, 1852-53, in surely as hopeless a position as ship's company ever waited in. But that ship's company never wavered in courage.

Their rations had had to be reduced in October, 1851, the beginning of their second winter, because of the loss earlier of a boat's load of salt meat, and then the loss of 500 pounds of preserved meat, found to have gone bad owing to fractures made in the tins in packing them in England. In October, 1852, the rations were further reduced and the lemon juice ration was halved[1] so that they were on starvation allowance through the third winter. In May, 1852, scurvy had begun, and now, of course, made rapid strides and the men were mostly too weak and disheartened even to hunt for game. Deer were plentiful however, and they continued to get some. Happily their record was found by one of the "Resolute" sledging parties and Lieutenant Pym arrived just a few days before the date on which it had been arranged that a party should set out to try to reach the coast of North America on foot. One can hardly doubt that their fate would in all probability have been that of Franklin's men who made the same attempt, with much less distance to cover. Eventually, after three and a half years of hardship and much suffering they crossed Melville Sound and were taken on board the "Resolute." They are described by an officer of this ship as looking, on their arrival, like men who were out of their minds. On board the "Resolute," one "Investigator" officer died of consumption, and later, on the "North Star," one man died from the effects of scurvy. All the others recovered. After another winter the "Resolute," along with the others of Belcher's ships, was in her turn abandoned and the "Investigator" veterans completed their North-West passage in the "North Star," "Phœnix," and "Talbot," relief ships.

The immunity from scurvy in the first two years of the "Investigator's" voyage, while exceptionally complete, was not greatly different from that recorded by other British ships of her own time. But the history is far other of that expedition that left England in May, 1875, on board the "Alert" and "Discovery" under Captain George Nares, to try to

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[1] By an oversight, it was erroneously stated in the *Lancet*, November 30, 1918, that the lemon juice ration was reduced in October, 1851, instead of October, 1852.

reach the North Pole.[2] They wintered, the "Discovery" in a bay in Robeson Sound, and the "Alert" on the north-east coast of Grantland, latitude 82° north. After preparatory sledging expeditions in the autumn, the principal sledging parties went out early in April, 1876, Commander Markham going due north and reaching the latitude of 83° 20′ 27″ N. Lieutenant Aldrich west along the north coast of Grantland, and Lieutenant Beaumont east along the Greenland coast. All three parties were severely attacked by scurvy soon after leaving their ships, the first case occurring within a fortnight in each crew, notwithstanding the fact that the "Alert's" men, that is, Markham's and Aldrich's sledge-crews, had had a double issue of lime juice daily for a month before they started.

The recommendations issued in 1875 to the ships' commanders by the then Medical Director General, Sir Alexander Armstrong, who had been Medical Officer on the "Investigator," conclude with the words: "Looking to the fact that this expedition will be one purely of exploration and discovery, and, unlike former ones, will be emancipated from the more trying duties of search, and with a greatly improved dietary and supplied with all modern improvements suitable to the Service, I am of opinion that, if the crews be carefully selected and the sanitary rules strictly enforced, the ships' companies should enjoy an immunity from scurvy, and a freedom from disease hitherto unknown in Arctic expeditions." That expectation was shared by all the officers. So well equipped were they that none of them anticipated scurvy; they did not think it a possible danger until at least the second winter, and the medical officers did not even think it necessary to give instructions to the sledging parties for its treatment should it appear.

The first case of scurvy was in January (1876), the patient being a man who had had access to the spirits and was believed to have drunk more than his ration. The case was therefore considered exceptional. No other case occurred until April when the sledges started, but then, with the sudden access of very hard work, scurvy at once developed, not in one or two, but in nearly all the members of the sledging parties. Of Commander Markham's party of seventeen every man and officer was stricken, and they were unable to complete their journey back to the ship until after a relief party had reached them. News of their plight was brought back by Lieutenant Parr who although suffering himself was still able to walk and did a fine forced march to the ship for help. In the meantime one man had died. Of the western party of eight, Lieutenant Aldrich and one man alone were able to drag the sledge and they were at the end of their strength when a relief party met them. Lieutenant Beaumont, whose party was twenty-four in all, got back near to Polaris Bay, on the other side of the strait from "Discovery's"

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[2] "A Voyage to the Polar Seas." Sir George Nares, 1877. Parliamentary Papers, "Journals and Proceedings of Expedition of 1875,"—1877, LVI. "Report of the Committee on Scurvy," 1877, etc.

quarters, when help reached them, and they had to remain there for some weeks under medical care before they were able to get back to the ship. They lost two of their number.

The men on the sledging journeys were, of course, exposed to severe physical strain, and Sir Alexander Armstrong says he always found that exceptionally hard work "favoured the development of scorbutic symptoms. Indeed, it was not an uncommon circumstance to find that men who were previously more or less debilitated, presented themselves after one day's very laborious exertion, with symptoms of scurvy well and fully developed." His view that incipient scurvy is quickly developed by over-fatigue is largely supported by other Arctic officers, and confirmed through history. But in the case of these ships, scurvy was not confined to the men with the sledges. The men who remained on the ships, who were not subjected to fatigue at all and who continued to drink their lime juice ration, the "idlers" as they were called, whose duties were on board ship, also developed scurvy. By 18th May, "Alert" had a sick list of seventeen, the whole of those left on board with very few exceptions.[1] The total number of cases in the expedition was sixty in the first year out, with three deaths, out of 122 men. This makes a very startling contrast with the previous history. The "Investigator" in her three-and-a-half terrible years had not more deaths from scurvy. The "Alert" was home in England within seventeen months of her departure. The "Investigator" was out for twenty-seven months, seven months of that time on reduced rations before her first case developed.

(ii) Official Inquiry into the Causes of the Outbreak of Scurvy in Nares' Expedition, 1876.

On the return of "Alert" and "Discovery" to England in October, 1876, a Committee was appointed to inquire into the reason of the outbreak. The equipment of the ships had been excellent and the officers had practically no improvements to suggest. The food supplies had been on lines that had been tested and proved by other, more fortunate, expeditions. Lime juice had been issued in accordance with the instructions of the Medical Director General, in the same way that he had found so efficacious on "Investigator," namely, one ounce of lime juice with one ounce of sugar was consumed each day by each man, in the presence of an officer. For fully a month before the sledging parties went out a double ration had been consumed daily on board the "Alert." No lime juice was taken out, however, by the early sledging parties. It had not been taken out by sledging parties on other expeditions, as it was frozen hard in the bottles at that time of the year and could not have been carried liquid until well on in May. It would therefore have required that extra fuel should be carried on the sledges to melt it, and it was not considered necessary.

[1] Sir George Nares in "Journals and Proceedings."

The Committee reported *that the early outbreak of scurvy was due to the omission of lime juice from the sledge dietary*, and that therefore the orders given by the Commander of the expedition were not proper.

Sir Clements Markham, then Secretary of the Royal Geographical Society, immediately published "A Refutation of the Report of the Scurvy Committee," 1877, in defence of Sir George Nares, in which he examined the evidence exhaustively. He shows that the conclusion does not agree with the bulk of the evidence, that it is in direct opposition to the opinions expressed by a large majority of the old Arctic officers who gave evidence, and of the medical officers of the expedition in question, and that it is only partially supported by the evidence of the other medical witnesses who had not Arctic experience. Nor does it take into account the facts that the first case of scurvy developed long before the sledge journeys started, that other cases occurred among men who never left their ships, and that cases occurred later on sledges that did take lime juice. Throughout the evidence of witnesses there is a reluctance to accept as the cause of the outbreak the stoppage for so short a time of the lime juice issue, but there is no other apparent cause of it. It continues to seem inexplicable, for other expeditions have had the same ration and have had much less illness, although out far longer than this one. Sir Clements Markham proceeds to examine the history of previous expeditions and concludes that "The rule is that Arctic sledging parties have never taken lime juice and have never had scurvy, and there are hardly any exceptions to this rule."

How utterly misleading to the general public that finding of the Scurvy Committee was may be seen from this sentence from the *Times* leader that appeared on 19th May, 1877: "Had it been possible to transport them instantaneously from England to the point from which their sledge journeys started, and had they then been sent on those expeditions without lime juice, they would, according to all existing experience, have fallen victims to scurvy." Nothing could be more untrue. All then existing experience was diametrically opposed to any such conclusion. The *Times* article is a long, ungenerous condemnation of Sir George Nares for having done exactly what all the great explorers had done before him with impunity. "The means, in fact, were all at hand," it says, "for obviating the disease which is the great enemy of all such enterprises, but by a lamentable failure of judgment they were not used." Admirals Sir George Richards and Sir Leopold M'Clintock, who had been among the greatest sledge-travellers of the Search expeditions, both wrote to the press stating that they had never used lime juice when sledging, and that there was no experienced Arctic officer living who would not have done precisely what Sir George Nares had done. The Report of the Committee simply failed to explain the outbreak of scurvy.

(iii) Detailed Comparison of the Diet of the Two Expeditions.

If, then, it is impossible to accept a theory by which all cases of scurvy on the "Alert" and "Discovery" sledges were due to the absence of lime juice from the sledge diet, and all cases on board ship were due to exceptional conditions of constitution or habits in the individuals, what theory does meet the case? What condition obtained to which all were subject and in which they differed from the crews of former ships similarly situated? Was there any important difference in the diet, through these months on board ship, which reduced the men to the point at which scurvy was ready to develop, on the application of sudden strain? In his narrative[1] Sir George Nares quotes from his journal of 9th February, before any sledging parties have gone out, before daylight has returned, "Everyone without exception is complaining of shortness of breath. I certainly do not remember experiencing the same at Melville Island (he was in 'Resolute,' 1852-54). In more than one instance severe running has been followed by blood-spitting in otherwise healthy men." So there was even then a distinct abnormality, and in the direction of scurvy, unremarked, be it noted, by the Scurvy Committee. Does any difference in diet account for it?

The general diet scale of "Alert" and "Discovery" was as recommended by the Arctic Committee, made out on the lines of the former expeditions, with every improvement that experience suggested. Herewith is a table showing the principal items of diet, compared with those of "Investigator's" diet, during first, second and third winters. It should be noted that "Investigator's" officers thought her supplies of meat from the first rather less than ample. Hence an increase in "Alert's" supplies.

The salt beef was the one item in the 1875 food that was not so good as the earlier supplies, in so far that it was too salt. It was the same kind of meat that Sir Edward Belcher's ships had, rumps and rounds of the best quality that could be procured, salted in the ordinary way; but it had absorbed more salt in the process than usual and was not liked.

The preserved vegetables were more varied, and Rear-Admiral Richards, who was in "Assistance" in 1852-54, says[2]: "I think the qualities were in many cases superior in the late expedition (i.e., the 'Alert' and 'Discovery'), because all preserved vegetables are now produced in a higher degree of perfection than they were in our time." It may be that greater perfection of preservation implies greater perfection also of the destruction of vitamines, so that their antiscorbutic value may be still further diminished. But "Alert" and "Discovery" had double "Investigator's" ration, as well as an extra supply of "compressed" vegetables, and double her ration of fruit.

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[1] "A Voyage to Polar Seas."

[2] Evidence, Scurvy Committee.

	"Alert's"	"Investigator's"		
	Winter scale	First winter in ice 1850-51	Second winter in ice 1851-52	Third winter in ice 1852-53
Lime juice and sugar	1 oz. each daily (lime)	1 oz. each daily (lemon)	1 oz. each daily (lemon)	½ oz. daily (lemon)
Flour for bread	3 lb. in four days. 9 oz. every 4th day, extra for puddings	1 lb. daily ..	⅔ lb. daily ..	⅔ lb. daily
Biscuit ..	1 lb. 1 day in 4 ..	—	—	—
Spirits ..	½ gill daily (doubled for some of the winter months)	1 gill daily ..	⅔ gill daily ..	⅔ gill, alternate days
Preserved fresh meat	1 lb. alternate days	¾ lb. alternate days	½ lb. alternate days	½ lb. alternate days
Salt or corned meat	1 lb. alternate days and ¼ lb. every 4th day	¾ lb. alternate days	½ lb. alternate days	½ lb. alternate days
Soup	½ lb. every 4th day	¾ lb. per week ..	None	None
Preserved vegetables	¼ lb. daily (Edward's potatoes, carrots, onions)	¼ lb. alternate days (Edward's potatoes and carrots)	¼ lb. alternate days (potatoes, carrots, barley and rice alternately)	2¼ oz. alternate days (potatoes, carrots, barley and oatmeal alternately)
Compressed vegetable	1 oz. every 4th day	None	None	None
Fruit	4 oz. per week with extra sugar	2 oz. weekly (cranberries)	None	None
Pickles ..	7 oz. weekly ..	6 oz. weekly ..	6 oz. weekly ..	7 oz. weekly
Peas	Less than ½ lb. weekly	1 lb. weekly ..	1 lb. weekly ..	1 lb. weekly
Tea	¼ oz. daily ..	¼ oz. daily ..	¼ oz. daily ..	⅙ oz. daily
Chocolate ..	1 oz. daily ..	1½ oz. daily ..	1 oz. daily ..	¾ oz. daily
Sugar.. ..	1¾ oz. daily and extra with fruit	1½ oz. daily ..	1½ oz. daily ..	1¼ oz. daily

Suet issued in lieu of flour, ½ oz. to 1 oz. flour.

½ lb. meat averaged 6 oz. when bone and fat were deducted.

There are two points to be noted here: First, there was a definite difference in the incidence of scurvy in favour of the officers as compared with the men. Why? On the sledge journeys, at first the men had more of the hauling, the severest physical strain, the officers having to pioneer and seek out the path; but as one by one the men failed, the officers had a greater and greater share of the extraordinarily arduous work of digging or pick-axeing a way through the snow or ice-hummocks and dragging the sledges over and through them. As the men became more and more unable even to walk and had to be carried on the sledges, the officers had very much the larger share of the sheer physical work added to their responsibility and anxiety. So, if over-fatigue is considered, there was nothing there in their favour. What else? They had the same food as the men on the sledge-journeys. On board ship, however, through the winter, their diet had included private supplies of wine ("sixteen glasses of wine per week, sherry, port or Madeira, and a bottle of brandy or whisky

every ten days.") And, beyond the ships' supplies, "butter, milk, cheese, jams, sauces, soups, rice, hams, tongues and a few vegetables." Here is a contrast in diet which should count considerably in favour of the officers and it seems to be the only significant difference.

Then there is a second point. There was a marked difference also in the incidence of scurvy as between the two ships, in favour of "Discovery," which had twenty cases out of a total complement of sixty, as against forty of the "Alert's" company of sixty-two; or, as eight men of the "Discovery" wintered on the "Alert," it should rather be put that of fifty-two who spent the winter on the "Discovery," fifteen men afterwards had scurvy, and of seventy who wintered on "Alert," forty-five. The difference in latitude of their winter quarters was only that between 82° 27′ and 81° 42′, but the "Discovery" lay in a sheltered bay, and on the land surrounding it there was a certain amount of vegetation, and therefore she got considerably more game in autumn and had fresh meat for fifty-three dinners in ten months, while the "Alert" had only fourteen fresh meals. Here is another contrast then, surely directly referable to the boardship diet, The officers' gain of weight during the winter averaged on the "Alert" 5 pounds 6 ounces, on the "Discovery" 8 pounds 13 ounces; the men's gain of weight on "Alert" 3 pounds 4 ounces, on "Discovery" 7 pounds 9 ounces.

Value of Fresh Meat in the Prevention of Scurvy.—The importance of fresh meat can hardly be exaggerated. Given enough fresh meat it may alone form a complete diet. Of course there are cases in history where scurvy occurs with a mixed diet including generous quantities of fresh meat, and it is only one example out of scores, that our soldiers in the Kaffir Campaign of 1846-47 had scurvy while they had "abundance" of fresh meat and biscuit, with rice for their only "vegetable." But if biscuit and rice had been omitted and they had had more fresh meat and only fresh meat, probably the scurvy would not have appeared. As is the case with fresh milk,[1] fresh meat is not sufficiently antiscorbutic to balance a diet of this sort, but where the food consists of nothing but fresh meat, enough of the antiscorbutic element is present to prevent disease.

The Hudson's Bay Company's people lived almost entirely on fresh meat and fish, without farinaceous foods at all; with nothing else, indeed, often, all winter. Dr. Rae, a surgeon of the Company for many years, and an active searcher for Franklin, said he had never had scurvy cases in the whole of the Mackenzie River District, and had only heard of it occurring at York Factory, a port on Hudson's Bay. He says:[2] "On many parts of the Mackenzie River they cannot grow any vegetables and I know that none are sent in because they are too heavy

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[1] Frölich, 1912, *Zeitschrift f. Hygiene*, vol. lxxii. Chick, Hume and Skelton, 1918. *Biochemical Journal*, vol. xii, p. 131.

[2] In evidence before Scurvy Committee.

to carry. The only thing we could have there would be Edward's preserved potato, but it is an immense distance to carry it, and it is never thought of because *they have never had any disease arising from want of vegetables.* Of course they get berries occasionally, but that is not in winter time, and it is usually only in small quantities." The Company's men generally got little or no vegetable food. At York Factory they kept lime juice because sometimes they had to live largely on salt meat. When there was not an ample supply of venison, then only Edward's desiccated potatoes and cranberries were issued, as it was found that scurvy might occur without; but when the fresh meat and fish were ample, the potatoes and cranberries were not given.

The quantities of meat used were large. When Sir John Richardson and Dr. Rae, with a party of English sailors and sappers, wintered at Fort Confidence on the Great Bear Lake, 1848-49, there were only twenty-five lbs. of flour or barley meal served out to each man during 240 days. The daily rations for all in the Fort were, to quote Dr. Rae's words[1] again: "8 lbs. fresh venison per man, 4 lbs. per woman, 2 lbs. each child; or 4 lbs. half-dried meat for a man, 2 lbs. for a woman, 1 lb. for a child; or when we had fish, 3 large white fish per man, 2 large white fish per woman and 1 per child. The fish ranged, according to my memory, from 3 to 4 lbs. each weighed, as taken out of the water."

Lieutenant Pullen,[2] who left the "Plover" in July, 1849, with thirteen men in two whaleboats, to search for Sir John Franklin east along the coast of North America, wintered with Dr. Rae on Mackenzie River. They had met with stormy weather in the boats, gales, mostly northerly, bearing down heavy ice on them on a lee shore, and they had had to throw overboard most of their provisions to save their lives. Some of the men wintered on the Great Bear Lake and lived entirely on fish, principally herrings, which they caught in nets set under five feet of ice. The others, on Great Slave Lake and at Fort Simpson lived as the Hudson's Bay traders lived, on dried or fresh deer meat and fish, brought into the stations by the Indian hunters. The allowance of flour for an officer was one or two bags per annum, and his guest shared with Dr. Rae the allowance; but the men had none. The rations of meat were as quoted above, 8 lbs. fresh deer or 4 lbs. dried (the dried meat was without bones). The men had nothing else to eat, except when game was to be had, which gave the only variety. In that case two wild geese was a man's daily allowance, or four ducks. The fish for Fort Simpson was brought from the Great Slave Lake in August, buried in the snow and dug out as required.[3] One fish day a week was the rule. In the officers' mess they sometimes had potatoes, but the men had none. Spruce tips were not eaten and no beer was brewed, neither spruce-beer nor any other sort. The only drink was water. Tea was not then issued by the Company and there was very little sent up even to buy, either of tea or sugar. No spirits or wine were issued to men or officers and they had none. At the end

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[1] To Scurvy Committee.

[2] Rear-Admiral Pullen's evidence, Scurvy Committee. Parliamentary Papers, 1852, LI.

[3] It is an interesting comment on the later chronic ptomaine theory that the fish was often "rotten" by the spring, "or what is called short; not offensive so far as smell went, still we were obliged to eat them." See also Dr. Redpath's statement in *Lancet*, November 23, 1901, that African natives eat decomposing meat and do not have scurvy.

of this winter of between eight and nine months, from early October to late June, Lieutenant Pullen's men were all fit, and eager to get back to the coast and carry on. They did so, came back again to Fort Simpson for a second winter, and got home to England in 1851. Lieutenant Pullen himself was the only man who ailed at all, and he did not have scurvy. And he never saw or heard of scurvy during his sojourn on Mackenzie River.

Mr. Campbell,[1] who had been chief trader in a branch of the Mackenzie River for fifteen years, 1837-1852, said he never had vegetables of any kind whatever and sickness was unknown among his people, "except sometimes being weak for want of food." He never saw a case of scurvy during forty years in Hudson's Bay. The Hudson's Bay pemmican, used by their people when travelling, was not commonly made with currants and raisins like the American, but plain, unsweetened. Only when it was wanted specially fine some service-berries were added.

A striking case of the use of fresh meat in extreme conditions is given by the second Grinnell Expedition under Dr. Kane, in 1853-55. When conditions were at their worst, in spring, 1855, and every man was seriously ill with scurvy, their condition went up and down in exact and immediate relation with their casual and irregular supplies of fresh meat. Again, during the first winter when all were affected, Dr. Kane himself was among the worst cases, but in the second winter his health was comparatively good, and he attributes this to his having been the only man on board who would eat the rats with which the ship was infested.[2]

Then there is the interesting case of nineteen people who were cut off from the American ship "Polaris" and lived on the ice-floe for six and a half months, in 1872-73, having already spent a winter on board ship in lat. 81°. They had with them some bags of bread, a quantity of pemmican, which would be the American sort with fruit in it, and a small quantity of chocolate, and they killed seals which they ate uncooked.[3] The party included two Esquimaux women and five children. They were picked up in May by a Scots sealer, all well.[4]

In his Presidential Address to the Royal Geographical Society in 1852, Sir Roderick Murchison speaks of Russian sailors on Spitzbergen, who had lived on game for more than six years, and three out of four were brought home in perfect health.[5]

Later, there is the case of Mr. Leigh-Smith's men on Franz-Josef Land, who when their vessel, the "Eira," was sunk, lived in health on fresh bear and walrus meat. Dr. Neale entitles his account of that experience "How to Avoid Scurvy in Arctic Regions,"[6] but as he does not tell how to ensure that there shall be bears and walruses to live on, he makes no new discovery. The regions

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[1] Scurvy Committee's Report, Appendix No. 28.

[2] "Second Grinnell Expedition," Dr. E. K. Kane, 1856.

[3] Of fresh meat, seal was believed to be more antiscorbutic than deer-meat; Dr. Kane believed in walrus-meat. McClintock says that white whale was greatly prized by the Greenlanders, and speaks of the pickled skin of the black whale as "a famous antiscorbutic."

[4] Report of Polaris Expedition, by Sec., U.S. Navy.

[5] *Roy. Geo. Soc. Proc.*, 1852.

[6] *Practitioner*, 1896, lvi. 585.

of the western Arctic have so much less open water that they have very much less game in winter than is met in the eastern Arctic.

Mr. Jackson has a story of six Russian priests who sojourned at Habarova, in Arctic Russia, a few years before his own visit there in 1893.[1] Their vows bound them to abstain from eating meat, and by the end of the second winter in the frozen land all had died of scurvy, while their servant, a young boy who had lived on reindeer, was in good health. Mr. Jackson himself and his eight companions of the Jackson-Harmsworth expedition to Franz-Josef Land in 1894, added fresh bear meat to an otherwise very full and complete provisioning, and had not a single day's illness in their three years.

It appears that in such cases as that quoted above, of our soldiers in the Kaffir campaign, the abundant supply of fresh meat does not give the amount of protection it should. This is probably due to the unvarying stew of the British Army. Probably about 100 per cent of the meat meals served in the Army abroad are cooked for two or three hours, and the meat and the vegetables cooked with it are thus robbed of one of their most important properties.

The staff of life, then, seems to be the one type of food that will not alone sustain life, and in comparing the history of the 1875 ships with that of the earlier ones, the occurrence of game is second in importance only to that of vegetables. But we do not find that the earlier ships had more fresh meat on the whole than had the "Alert" and "Discovery." Dr. Armstrong[2] writes, of "Investigator": "In the autumn of 1850 we were fortunate in procuring some musk-oxen, the flesh of which was issued in lieu of salt beef, at the rate of one pound per man each week, and occasionally three times a fortnight, for a few months. In the following summer we were equally fortunate in procuring game, consisting of wild ducks, geese and ptarmigan, which for about three weeks afforded us a pound of fresh meat weekly. Throughout the winter of 1851-52, owing to the circumstance of meeting with reindeer, we were enabled to issue a pound of fresh meat three times a fortnight, the allowance being subject to occasional interruptions, and birds were procured in the summer as before. For several months of the third winter we were also enabled to continue the supply of reindeer, and occasionally the supply was continued in the spring." That is, in the first winter, the time comparable with "Alert" and "Discovery's" winter, they had one pound of fresh meat a week, or sometimes three pounds in two weeks. This is more than "Alert's" fourteen meals in ten months; but it is much less than "Discovery's" total 18,000 pounds of game, or 800 pounds of fresh meat issued per month, i.e., 15 pounds per head per month, a supply equalled by few previous expeditions.

Herbs and Vegetables available.—On most of the ships attempts were made to grow mustard and cress, but with very indifferent success. Some

[1] "The Great Frozen Land," F. G. Jackson, 1895.

[2] "Naval Hygiene and Scurvy."

was grown on board "Investigator," but not much. On board "Alert" and "Discovery" there was never enough produced for a general ration, and only the officers had a little occasionally.

On the "Investigator,"[1] "In the summer of 1852, for a period of nearly three weeks, we were able to procure limited supplies of sorrel (*Rumex acetosella*) and scurvy-grass (*Cochlearia officinalis*), which were daily issued in variable quantities of a few ounces. This was the only fresh vegetable food that we ever obtained." The later expedition also got sorrel in summer, but by that time of course they already had scurvy rampant.

Beer supplied.—There was a small difference in the beer used by the two expeditions, which, had it been brewed from the air-dried malt of Captain Cook's time, might have told in favour of the earlier ship. Both carried Allsopp's Burton ale in casks, which lasted perhaps through the first winter; but in the "Investigator" small beer was also brewed on board and issued occasionally. Had there been any antiscorbutic value in either of these beers, the ship that had the fresh brew would presumably have been at an advantage; but malt was by that time "high-dried," so there was probably none.[2] The beer consumed on the "Alert" was not more than half-a-pint per head, two or three times a week, and if rather more was used by the "Investigator's" crew, any gain to the latter would certainly not balance the disadvantage they were under by their larger consumption of rum. In any case, the quantities used were so small that the variation between the two may safely be disregarded.

Questions of conditions on board Nares' ships, work and exercise, ordinary diet, fresh meat and vegetable supplies, and many others were considered in great detail by the Scurvy Committee. Several Arctic leaders concluded that in the absence of any other apparent reason, the harder work Nares' sledging parties had had than most, though not all of their predecessors, must account for their extraordinary misfortune and Sir George Nares himself was of this belief.[3] Many expressed their continued opinion that it was unaccountable. The Committee reported that it was due to the failure of the sledge-parties to take lime juice; but the impression remained which was afterwards expressed by Admiral Richards.[4]

"Much stress has naturally been laid on the superior equipment of this Expedition and on the great advantages it possessed over previous ones; but when we come to analyse those advantages they are more apparent than real. Doubtless no ships could have been more efficiently

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[1] "Naval Hygiene and Scurvy."

[2] Harden and Zilva, *Journal of the Institute of Brewing*, 1918, vol. xxiv, p. 197.
(A) Henderson Smith, *Lancet*, 14th December, 1918.

[3] *Journals and Proceedings*, Parliamentary Reports, 1877, LVI.

[4] Introduction to Nares' "A Voyage to Polar Seas."

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equipped or better provisioned, yet in this respect there could scarcely have been any appreciable difference between them and the numerous expeditions which had been employed previously in the search for Franklin. In all their arrangements the Government were actuated by one principle —efficiency and comfort—regardless of expense. Yet we find the travelling parties of the present Expedition attacked by malignant scurvy which almost prostrated them after one winter in the ice, though happily the mortality exceeded that of no former expedition. If we turn to the records of the condition of crews of Collinson's and McClure's ships after three and four winters passed in a much lower latitude we find an absence of any severe case of the same disease, and so in other voyages of shorter duration. . . . These are significant facts, the causes of which have hitherto been past man's finding out."

The discussion of the Commission might almost be summarized in words of John Woodall, written in 1617, "Truly, the causes of this disease are so infinite and unsearchable as they farre pass my capacity to search them all out. . . . Some charge Bisket as a cause of the scurvie but I am not of their opinion; some say inordinate watchings are the cause thereof; some say extreme labour wanting due nourishment; some also affirme cares and griefe to be some cause thereof; others affirme the very heat of the aire, resolving the spirits; but what shall I amplifie further? for it is also true that they which have all the helps that can be had for mony, and take as much care as men can devise are even by the evil disposition of the aire, and the course of nature, strook with a scurvie, yea and die thereof at sea and land both."

(*To be continued.*)

THE HEART DISORDERS OF SOLDIERS—AN ANALYSIS OF ONE THOUSAND CASES.

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Among the numerous morbid conditions arising as a result of the stress and strain of warfare, one is not surprised to find that cardiac disturbances are fully represented.

The theme of this paper is a brief review of the heart disturbances directly associated with and caused by the active service conditions which nowadays exist, and though dealing mainly with disorders definitely traceable to some such condition, one must not forget the large number of cases in which it is quite clear that military service has but precipitated some pre-existing debility which may or may not have caused symptoms during civilian life.

There are, in fact, two main groups:—

(I) That in which the condition is clearly originated by some agency during military service, and

(II) That in which evidence exists of disease being present before enlistment.

The basis of the present paper consists of 1,000 consecutive cases of patients transferred from their units because of some heart debility, and of this number it is found that 614 belong to Group I, and the remaining 386 to Group II.

The nomenclature at present applied to the vast majority of all these cases is simple; they are massed under one heading, the all-embracing group "Disordered Action of the Heart" (D.A.H.), a title in itself singularly unfortunate, in that it is certainly unscientific, and, in addition, often quite inaccurate.

The full equivalent of the abbreviation is rapidly grasped by the patients and, firmly backed by the lay opinion, they become convinced that their condition is serious, and that their ultimate cure can only be compassed by months, and possibly years, of careful rest and treatment. The early interpretation of the term is, however, not its sole drawback by any means; it is also unfortunate in that it is extravagantly elastic, applicable equally to the trivial and the serious cases. Hence we find the same name applied to all cases, irrespective of the gravity of the condition. For instance, the harmless irregularity which depends upon the respiratory phases, the occasional occurrence of a premature beat, the tachycardia of anæmia or emotion, and other states equally unimportant, are grouped, from the very earliest stages, with really genuine disease, such as valvular mischief, infective processes of various kinds, and auricular fibrillation.

It is commonly accepted, and with perfect reason, that progress towards

recovery is largely influenced by tne mental attitude of the patient, and it is quite obvious that the herding of the mild and trivial with the serious can only be prejudicial to the rate of recovery of the former.

The D.A.H. problem, from the nomenclature point of view, is an extremely difficult one, therefore, and very much more serious than may at first sight appear. High as has been the toll of the wastage from heart disorders of all warfare in the past, one is inclined to think that, in view of certain modern agencies which science has evolved and adapted, all the deadly refinements and latest types of the weapons of slaughter which mankind has chosen to utilize, the percentage loss from heart disease is higher than ever before in history. At the same time, however, as we acknowledge this statement, it is just noteworthy that we are able, in some measure, to qualify its significance. One consoling factor obtains, and it is that numerous are the cases sent down from their units labelled "D.A.H." whose condition, primarily, is certainly not a cardiac one; in other words, the diagnosis is faulty. The heart, as for example in patients suffering from shell-shock and allied conditions, is more often than not very far from being the chief offender. It can, however, and does, give expression to such conditions in a variety of different ways, and if we remember that the heart is enabled, unlike some other organs, to publish with ease its varying objective phenomena, one is not surprised that physical *signs*, be they primary cardiac, or reflex in origin, tend usually to be attributed to the heart. In other words, numbers of cases are seen and labelled "D.A.H." in whom the cardiac phenomena are quite secondary to some other underlying state, and which, if subjected to closer investigation, would more correctly have been labelled in accordance with the primary source of the mischief.

It would in fact be distinctly more rational to delete the term "D.A.H." from our present vocabularly and substitute an entirely different method of diagnosis for these cases. Conditions primarily cardiac should be labelled as such if no doubt exists as to the diagnosis and evacuated under some one of the ordinarily accepted terms, preceded, if need be, by the abbreviation "N.Y.D." Should, however, the cardiac condition be secondary, the primary factor should be noted as the diagnosis and followed, if thought advisable, by the term "N.Y.D. C."

As an example we may consider an ordinary case of shell concussion. The nervous system is disorganized in varying degree and the heart frequently suffers some functional derangement, more likely than not of a fleeting character. It seems obvious that our present method of labelling such cases is unfortunate in that we brand them from the start with what turns out to be an extremely treacherous title, in itself prejudicial to progress and recovery.

For this reason it is suggested that the wisest course to adopt is to adhere strictly to the primary cause when entering a diagnosis, whether it be shell concussion, trench fever, rheumatism, gas poisoning, or any

other well-known causative factor. These, and other maladies of a similar character, are frequently complicated, and possibly it may seem that the heart is the chief organ affected. Should this be so, the letter "C" (cardiac) should be added after the name of the primary disease; or, if the heart is only under suspicion, the term "N.Y.D. C." might be used with advantage.

Adopting this method of nomenclature we should substitute diagnoses, as for example the following: Anæmia, "N.Y.D. C."; rheumatism, "C."; trench fever, N.Y.D. C."; shell gas poisoning, "N.Y.D. C.," for the unfortunate and inappropriate term "D.A.H." at present in vogue, and incidentally obviate in great measure the introspective element which tends to develop so rapidly.

Leaving now the question of diagnosis, it will be well to consider as shortly as possible the etiological question, and outline, under their respective headings, the different types of the condition from the point of view of causation. With this object in view the accompanying table is inserted:—

TABLE OF CASES ANALYSED ACCORDING TO ETIOLOGY.
All admitted with the Diagnosis "D.A.H." or "V.D.H."

		Fit	Referred for re-classification
1	Post pyrexial (trench fever, P.U.O. influenza, etc.)	81	120
2	Gas poisoning	50	57
3	Heart disease (valvular, myocardial, etc.)	–	134
4	Languor cordis	82	158
5	Shell concussion	52	41
6	Rheumatic carditis	26	104
7	Resulting from previous disease: bronchitis, pneumonia, typhoid fever, dysentery, etc.	21	74

It sets out in tabular form a simple analysis of the cases, and by this method of grouping it becomes easier, not only to weigh up the significance of symptoms, but also to deal more satisfactorily with the question of prognosis.

Group I is entirely devoted to the cases in whom the affection arises as a direct result of trench fever, a disease unfortunately very prevalent, and one whose complications are extremely numerous. In spite, however, of the vast number of cases which daily present themselves, and of the researches which have been, and still continue to be, undertaken, the fact remains that the pathology of the disease continues uncertain. The organism is, as yet, not satisfactorily isolated, and the present state of our knowledge can shortly be summed up in that we strongly suspect the disease to be one of an infectious nature, and that the germ is conveyed and spread from man to man by the agency of the body louse. That such is the case can only be surmised for the present, but in the

meantime it is possible to state that, in common with other diseases of an infectious nature, trench fever can, and does, produce cardiac disturbances analogous with those resulting from the circulation in the cardiac muscle tissue of some specific organism or the toxin of such.

Happily, however, all cases of trench fever do not develop cardiac symptoms. It is but a small percentage, and one, moreover, capable of further reduction if adequate attention be paid to the early stages of the condition and the period of convalescence. This latter cannot be too strongly advised. Undue hurry is fraught with disaster later, and cases returned too soon to duty exhibit a very noteworthy proneness to cardiac debility in some shape or form, necessitating invaliding for a second and possibly very much protracted period.

Early symptoms indicating mischief in the heart muscle, though vague in their initial phases, begin, with very few exceptions, to make their appearance before the primary disease has been satisfactorily eradicated. The patient will complain of discomfort with slight exertions, the cardiac reserve power is evidently below the normal, and it is not long before definite symptoms make their appearance. Shortness of breath, undue exhaustion with exercise, palpitation, more especially at nights, and faintness easily produced are among the earliest of the complaints noted. But before long further disabilities arise. Excessive perspiration with even the smallest effort, postural giddiness and certain of the phenomena which herald the primary stages of dilatation, viz., præcordial pains, troublesome and persistent palpitation, an inability to sleep on the left side, and smothering sensation at nights.

Among these early and initial symptoms it is on pain that the priority of stress is laid with remarkably few exceptions, both in the case of the young adolescents in whom dilatation so readily occurs, and in the older patients where this latter phenomenon cannot so easily come about. Sensations of pain and discomfort, though aggravated by exercise and exertion, persist even in the resting intervals and vary in degree more often than not, according to the severity of the primary condition. In this respect they conform to the comparable states which obtain in any of the recognized types of toxic angina.

From the point of view of actual causation one may conveniently divide pain into two main groups:—

(1) Intracardial: the heart muscle itself or the different nerve-endings being poisoned by toxins or possibly even micro-organisms circulating in the blood-stream ; and

(2) The extracardial for which dilatation is mainly responsible, in that it causes pressure not only upon the superficial and the deep cardiac plexus, but also upon the intercostal nerves and other structures and nerves in the vicinity.

In type also the pain may be discussed from two standpoints :—

(1) The local, as, for instance, when an intercostal nerve suffers direct irritation; and

(2) The referred.

The latter type may be, without demur, accepted as the more important of the two varieties; in fact, the theory of referred pain has no more efficient an exponent than the heart proves to be.

Developmentally the heart is connected with the first eight thoracic segments, and the aorta (ascending and transverse arch) with those of the third and fourth cervical. Assuming, therefore, an irritation of certain of these segments by morbid processes located in the heart's muscle or fibrous tissues, and the projection of such impulses from the segments so involved to their peripheral distribution, we are not surprised to find definitely circumscribed patches of hyperalgesia, together with hyperæsthetic zones of skin appearing on the thoracic wall and the inner surface of the arm, and their significance from the point of view of diagnosis is of great value.

The chief points noticed in the examination of patients suffering from the heart complications of trench fever are the following:—

(1) An outward displacement of the apex beat, possibly reaching even the mid-clavicular line, and tender to even the lightest pressure and percussion.

(2) An increase in the area of cardiac dullness (light percussion only is advised, and proves to be the most accurate method); the dilatation, when present, is general, and the dullness is increased in all directions, both upwards, outwards, and inwards.

(3) An increased rapidity of heart rate, as a rule only very slightly marked in the resting state, but instantly assumed with the adoption of the erect position, aggravated even further by exercise, and returning to the resting rate only after an abnormally long interval.

(4) A rhythm unduly influenced by the respiratory phases, and punctuated frequently by the occurrence of premature contractions.

(5) An accentuation of the first sound at the apex, the valvular element of the sound predominating, and imparting a distinctly metallic clang to the tone of the sound. More often than not it is found that the extreme loudness of the sound obscures the presence of murmurs, and these latter appear if the patient rests in the recumbent position for a few minutes. In conjunction with an outward extension of the cardiac dullness to the left, a systolic murmur heard at the apical region, and external to it, undoubtedly indicates dilatation of the ventricle, including the valve, and probable regurgitation to the atrium.

(6) A systolic bruit with an accentuated second sound and a diastolic shock at the pulmonary area; these, with an impaired note in the third space, or even at the costal cartilage of the third rib, indicate upward dilatation of the right ventricle, the pulmonary orifice being in consequence displaced in an upward direction, and as a result the walls of the pulmonary

artery develop an unnatural laxity; hence the production of a fluid vein and an audible bruit.

These, then, are the more striking of the physical signs which one notes on examining a patient whose heart affection follows trench fever, and experience permits one to attach more importance to certain of these than to others. From the point of view of prognosis, one looks with doubt upon the following:—

(*a*) Excessive pain, apical tenderness and patches of hyperæsthesia; (*b*) continual tachycardia, resting rates of 100 and above; (*c*) persistent dilatation; (*d*) multiple premature beats; (*e*) obvious distress with test exercises, giddiness, dyspnœa, etc.; (*f*) flinching when the præcordium is being percussed; (*g*) a diffuse and wavy apex throb spreading inwards to a retraction with systole of the area covering the right ventricle.

Group II includes the patients whose cardiac mechanism has been rendered inefficient as a direct result of the inhalation of poison gas, quite apart from the other lesions, those of exposed mucous membranes, viscera, etc.; it is very evident that the lungs and the heart are the organs which merit the strictest attention, for it is upon them that the strain and the brunt of the initial damage undoubtedly falls.

In conformity with other rapidly acting poisons one views the primary stages of the condition with the greatest degree of uncertainty. Active treatment of a very specialized kind, which need not be discussed here, is instituted, and decided improvement at the end of forty-eight hours is looked upon as favourable. Progress towards recovery is slow, and it may be ten to fourteen days before convalescence can be confidently stated to have commenced. This latter is slow in all cases, and final recovery is by no means certain. Improvement is the rule, but unfortunately numbers of patients do not get beyond this stage. Complete cure appears impossible and this can generally be explained by the fact that there has been some previous mischief, possibly of the nature of bronchitis, pneumonia, or other malady. Or, on the other hand, the age of the patient may be the deciding factor, the prognosis being strikingly more favourable in the younger men than in those approaching middle life.

From an analysis of the notes dealing with patients in this group, the following list of the more frequent symptoms has been prepared;—

(1) General symptoms: Exhaustion, lack of energy, dizziness and headaches.

(2) Pulmonary symptoms: Cough, loss of voice, soreness, and weight on the chest, shortness of breath, tenacious expectoration which is worse (*a*) upon hot days; (*b*) when the weather is very damp; (*c*) when the patient gets warm in bed at night.

(3) Gastro-intestinal symptoms: Unpleasant taste in mouth, nausea, dyspepsia, enteritis, hæmorrhage, and excessive flatulence.

(4)[1] Symptoms the result of lesions of the various mucous membranes: Discharge from the eyes, adhesions of the lids, varying degrees of impair-

ment of vision all aggravated by strong sunlight, and possibly sufficiently severe to cause temporary blindness; obstinate catarrh of the nasal passages and the naso-pharynx.

(5)[1] Burns of varying depth which involve not only exposed surfaces but also the areas of skin where perspiration is active.

Physical examination discloses signs characteristic of the above-mentioned symptoms. It is, however, towards those more especially connected with the heart and lungs that we are at present directing our attention, and these organs require a very careful scrutiny during the entire convalescence.

One notices, on observation, that the respiratory rate is excessive, and that its rhythm is abnormal; the average excursion is shallow, and the depth of individual phases varies, a moderately deep inspiration being followed by several, possibly three or four, short and jerky respiratory movements. The rate per minute, which has been recorded during the resting intervals, ranges between thirty and seventy, and it is significant that even the highest rates do not as a rule cause any marked degree of distress or anxiety to the patient while he refrains from exertion. High rates of breathing, therefore, characterize the patients who have been subjected to gas poisoning, and, contrasted with the normal rate, fourteen to eighteen per minute, they indicate gross damage to the respiratory mechanism.

We know that at all ordinary times the phases of respiration are under dual control, the vagal and that of the respiratory centre, and further that these latter are both connected and complemental the one to the other. In the vagus nerve there are found to be two sets of different fibres, stimulation of one set causing increased activity of the inspiratory part of the centre, and stimulation of the other set causing increased activity of the expiratory part of the centre; and these two sets of fibres are alternately stimulated by the alternate distension and contraction of the pulmonary air vesicles, where the vagal terminals ramify.

In addition, however, to this, so to speak, peripheral arrangement, it is found that the respiratory centre is possessed of further functions enabling it to control and manage the varying rates and magnitudes of excursion which may become warranted both in the conditions of health and disease. These it governs by reason of a property with which it is endowed, viz., an elasticity of action depending upon the relative acidity of the blood. In other words, the activity of the centre is regulated by the reaction of the blood and the rate of respiration varies in direct proportion to the amount of acid concentration which may obtain. This latter is found to be a variable quantity. In health we are aware that a continual stream of carbonic acid is thrust into the blood-stream as a result of ordinary tissue metabolism. This, however, does not materially influence the reaction of

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[1] Paragraphs (4) and (5) refer to the so-called "mustard gas" only.

the blood, for it does not remain entirely free. There are in the blood certain salts, sodium bicarbonate and sodium phosphate, also protein bodies, which possess a definite affinity for carbonic acid. These so-called "buffer salts" enter into a loose chemical combination with the carbonic acid in the blood and by so doing, prevent the development of an undue acidity, and promote the necessary adjustment between the reaction of the blood and the activity of the respiratory centre which must obtain if the normal rate of breathing is to continue.

This adjustment suffers dislocation both in health and disease. We know that increased respiration both as regards rate and amplitude is the normal sequence to exercise. The explanation is obvious, for in addition to the spread of impulses which, during exertion, pass from the motor cortex to the respiratory centre, there is a definite increase in the relative acidity of the blood. Owing to the more rapid metabolic changes which necessarily accompany exertion, the blood becomes temporarily overcharged with carbonic acid, more even than can be dealt with by the "buffer salts," also lactic acid; and the centre is stimulated to increased efforts until the excess of these acid products is satisfactorily excreted. Dyspnœa in diseased states is capable of interpretation upon entirely similar lines, for, apart from those patients in whom the breathlessness is a direct result of deficient aeration of the blood, there are quite a number of diseases in which acid intoxication, following perverted metabolism, furnishes the underlying stimulus to extra effort on the part of the respiratory centre.

If for a moment we now consider the position of the patient who has been subjected to the influence of poison gas, it is quite evident that the most important of the resulting disabilities is the deficient blood aeration. This latter allows of explanation pathologically. The pulmonary air sacs and bronchial tubes are flooded by exuded fluid and serous effusion, and in consequence the respiratory exchange is seriously interfered with in both directions. Oxygen starvation follows, and the CO_2 not being satisfactorily eliminated, cyanosis and asphyxia follow. This explanation of affairs applies more especially to the early stages of the condition, and it is necessary to examine more closely for the reason of the dyspnœa continuing during convalescence and after all the bronchitic signs have cleared up. The explanation is not far to seek, for changes of a permanent character are induced in the lung tissue by the irritant vapours and the intense respiratory efforts which these latter give rise to. These changes include damage to the specialized pulmonary epithelium and a varying degree of actual emphysema; morbid processes which seriously hamper the even and orderly gaseous interchange in the lung tissues; both the intake of oxygen and the exit of CO_2 are impeded, but in view of the fact that cyanosis is not, as a rule, present to any noticeable extent, it seems evident that oxygen want is the prevailing factor and the more important agency provoking extra effort on the part of the respiratory centre; the pulmonary ventilation rate is accelerated in order to compensate for this oxygen

deficiency, and the likelihood is that this depends upon the production of a shift of the reaction of the blood in the acid direction, producing a condition comparable to that which is brought about in the normal subject when, at an altitude, he develops a compensatory acidosis to counteract the oxygen want resulting from the lowered alveolar tension of this gas.

The cardiac derangements are entirely secondary to those in the lungs. Owing to the emphysema we frequently find a diminished area of cardiac dullness. The rate of beat is rapid and shows an excessive rise with effort. Some degree of dilatation is the rule and the characteristic murmurs are observed. Premature beats are often noted in those cases which present evidence and history of profound initial toxæmia.

Group III of the series comprises all the cases of genuine heart disease irrespective of those following the rheumatic affections which will be discussed under a separate heading.

These patients invariably fix the onset of their symptoms as having occurred at some date during civil life, and owing to their disability they have been advised to choose an occupation of a sedentary character as a conservative measure. Hence we find on glancing at the previous occupation in the notes upon the cases in this group that their business was invariably one requiring a minimum of active muscular exertion, and the quieter walks of life, for instance, that of the schoolmaster, the clerk, the painter, the sign-writer, the weaver, etc., have been for this reason followed.

One is not surprised to find that military training suddenly imposed upon inactive subjects with latent disease is a slow and, in the long run, ultimately an unsuccessful process. They develop symptoms of distress and exhibit rapid and premature exhaustion with their exertions. The effects of the latter evince cumulative characteristics, and failure surely appears, itself very frequently precipitated by some intercurrent affection, such, for instance, as an attack of tonsillitis, P.U.O. influenza, or other debility of like nature.

Needless to say this type of patient is certainly not going to be cured, or even efficiently enough improved for the full duty of a soldier, by any amount of hospital or convalescent treatment. He may, very possibly, make progress sufficient for the duties which a low category of service demands, but even this result is by no means certain, a fact which becomes perfectly patent if we, for a minute, inquire into the case analysis and incidence of the conditions embraced by the group under consideration. These are as follows:—

(*a*) **Mitral incompetence**	69 cases
(*b*) „ „ with obstruction	16 „
(*c*) „ stenosis	11 „
(*d*) Chronic myocarditis with dilatation	31 „
(*e*) Aortic disease..	3 „
(*f*) Auricular fibrillation	3 „
(*g*) Dextrocardia	1 case

Beyond the fact that pains are considerably more obstinate and that premature beats, when present, are more apt to proclaim their existence by some such method as a fullness in the region of the heart, a suffocating feeling in the throat, or a sensation as though the heart had stopped beating, there are but differences in degree between the symptoms which characterize this and the other groups of cases. In both we recognize deficiency of reserve heart energy, but this, as one would naturally expect, is certain to be more noticeable when it results from disease of a permanent type than it is in those cases where the heart is suffering but a temporary and functional derangement. Further, we notice that the classical group of symptoms which indicate failure is usually complete in the organic, while in the functional cases it is customary for some one or two of the symptoms to be mentioned without reference to others. For instance, a patient with tachycardia following shell-shock may complain of shortness of breath and giddiness without any mention of palpitation.

Physical signs are undoubtedly more abundant in this group than in any of the others. Careful examination of the pulse furnishes its ever important share of illumination in the question of diagnosis. The rate and rhythm are noted; its quality and volume are examined. By these methods we gather valuable confirmatory evidence which materially aids us in arriving at a correct diagnosis, not only of the disease which may be present, but also the stage it has reached. We recognize, for example, and appreciate, the relatively small pulse of mitral disease and aortic obstruction, and the collapsing nature of the pulse which accompanies aortic incompetence and pure dilatation without hypertrophy.

A few moments in actual inspection of the chest and præcordial area is always time well spent. One notices, possibly, some amount of deformity, or bulging of the chest wall, the position and character of the apex beat or impulse, the wavy systolic retraction which speaks for a dilated or hypertrophied right ventricle, abnormal impulses at the area covering the auricles and the origins of the great vessels, and possibly even certain obvious phenomena which indicate pericardial adhesions, viz., a systolic retraction in the region immediately external to the apex beat, and an absence of movement with respiration of the triangular space at the base of the sternum.

The heart's size is defined by percussion, and certain points in the technique of the latter require attention. Undoubtedly it is better to percuss in the upright position and to confirm if necessary later with the patient lying down. In the latter position it is sometimes an advantage to wear a stethoscope whose chest piece hangs near the area which is being percussed. By this means changes of note are readily appreciated. Should the pectoral muscles be unduly prominent, it is an advantage to percuss with the arms loosely extended over the patient's head. The actual percussion needs great care. Undoubtedly the more accurate results are obtained by light as opposed to heavy percussion. As an index to quality

the following plan is considered to be the most efficient; first to locate the apex beat and then to find the degree of percussion which most clearly demarcates the transition from resonance to dullness in this particular area. By this method we become possessed of a guide to the particular intensity which the percussion must assume in order that the limits of cardiac dullness may be satisfactorily mapped out and defined.

Certain of the signs which are revealed by auscultation merit a very careful study. Particular attention should be paid to the quality of the respective heart sounds and the time intervals between them; that is to say, the systolic period and the diastolic interval, the latter of these two being especially worthy of note. As regards the first heart sound, we know that it is of triple origin, the contracting ventricle and the closing valve combining with the pressure of the blood column to produce a complex sound; hence, we are able to appreciate the fact that the first sound varies within certain limits depending for its variations upon the values of its several components. We hear, for instance, a dull and muffled sound in cases of ventricular hypertrophy, the muscular element predominating, a high-pitched and shortened sound of valvular origin in cases of dilatation with enfeebled musculature, and a general diminution of the entire sound if the blood-pressure be below normal.

Venous murmurs are frequent and easily recognized, not only the bruit-de-diable resulting from the loss of tone in the walls of the cervical veins, but also the vena cava murmur which, following the course of the vessel, can best be heard in the first and second spaces immediately to the right of the sternum.

The diastolic murmur, which indicates regurgitation at the pulmonary valve in cases of early mitral stenosis, is seldom noted. This may be accounted for by the fact that the pulmonary venous channels are capable of accommodating more than their normal amount of blood, should the necessity arise.

The so-called triple or canter rhythm is relatively common and its correct interpretation is by no means a simple matter. The third, or extra, sound which makes its appearance and so changes the normal sequence of events may depend upon one of several factors. The following are the more common:—

(1) Reduplication of the normal first sound. This may occur in cases of mitral stenosis and aortic incompetence as the result of a double closure of the mitral valve, or it may be due to an asynchronism in the systole of the right and left ventricles.

(2) Reduplication of the second heart sound. The abnormal rhythm is, in this case, heard better at the base than at the apex, and depends for its presence upon a disturbed relationship arising between the pressures in the pulmonary and systemic circulations.

(3) Audible contractions of the atrium; such may be the state of affairs both in certain phases of heart-block and in extreme tachycardia.

It is interesting also, to note the frequency with which it happens that a loud and accentuated reduplication of the first sound at the apex in the standing position is replaced, if the patient lies down, by the typical bruit which indicates mitral incompetence. For this, and other reasons, far too numerous to mention, it is highly important and necessary that all cases of heart disorder be examined both in the lying and standing positions. Too much stress need not be laid upon the appearance of a systolic bruit at the apex which is quite localized at this spot, heard only in the recumbent position and unaccompanied by other physical signs. But one should not forget to listen in such a case for the first sound. This may be inaudible at the apex, replaced here by a murmur, but appear quite normally immediately external to the apical region, and certainly indicates no gross or permanent disability. The case is different, however, if the following combination be present; a systolic murmur at the apex, not conducted outwards, and with it an entire absence of the first sound both at the apex and external to it; this invariably indicates permanent incompetence at the mitral valve.

Group IV consists of 240 cases, exhibiting features of cardiac debility in varying degree without any appearance of gross lesions or even a history of any of the diseases which one associates with heart maladies from the etiological point of view.

From the table one sees that the percentage of cases actually cured by treatment and convalescence, is extremely small, and far outnumbered by those in whom improvement fails to occur or is so incomplete that reclassification becomes inevitably the only solution. The latter, numbering 158, includes ninety-seven cases whose disability dates back to early youth, or, at any rate, to civil life, and sixty-one cases in whom the initial symptoms appeared during military service. Similarly, one may divide the cured cases. Of these, nineteen gave a history of similar symptoms in civilian life, while sixty-three did not experience appreciable disturbance until their military duties began. Quite apart, however, from the actual date of the onset of the first symptoms, we notice that all the patients in this group are drawn from sedentary occupations, clerks, students, printers, weavers, fitters, commercial travellers, to mention only the chief types of employment which, prior to the war, had been adopted. It is, moreover, customary to find on inquiry that these patients were advised to take up work needing a minimum of exertion because, for various reasons, the more strenuous occupations were contra-indicated. All the more violent of athletics and outdoor exercise have been sedulously avoided. One can be hardly surprised to find what appears to be the typical sequence of events. A delicate and poorly developed man is suddenly transferred from a sedentary mode of existence to one which involves not only hardships and endurance but a plenteous supply of grit and stamina; he undergoes his training with possibly nothing more than a suspicion of general unfitness, as evidenced by rapid exhaustion following exercise, or some degree

of discomfort after marches; but on the other hand cases do frequently present themselves who definitely and emphatically connect their conditions with some phase or other of their training. The significance of these early symptoms may not be grasped, but the stress and strain of active service will sooner or later expose the true state of affairs. The final and determining agent may be one of several, e.g. :—

(*a*) Climatic changes; (*b*) exposure, damp and cold; (*c*) heavy marching with pack and equipment; (*d*) a wound; (*e*) the lifting and carrying of excessive weights, ammunition, rails, etc. Each or any of the above operating alone or collectively is fully capable of exciting mischief in those whose powers of resistance are abnormally low. The poor quality of the heart muscle is swiftly betrayed by the customary symptoms of incompetence; the circulation and in fact the entire organism suffers in consequence of the feeble vitality of the cardiac musculature; the subjective phenomena and the objective signs together indicate decided mechanical weakness, and express the results which strain produces on an organ whose vital powers are primarily below par.

Such a condition with intrinsic disease unrecognizable, but eloquent of an impoverished muscle power, seems to be suitably named "languor cardis," and it is suggested that such is the most satisfactory title under which to describe the cases dealt with in this group.

The symptoms of this condition are in no way peculiar, but conform to those which one accepts normally as indicating incompetence and inefficiency of heart power and reserve. More often than not the complaint is of weakness and premature exhaustion, with pain in the side and periodic spells of faintness and giddiness. Palpitation also is noted in the majority of cases. This depends largely upon a hyperirritability of the sympathetic nervous system which presides over the heart's enervation, and indirectly also upon the co-existing states of anæmia and lowered blood-pressure.

This latter presents several points of interest. The systolic pressure is below normal; so also, and more in proportion, is the diastolic; pulse pressure tends in consequence to be high; the depression in the diastolic reading is taken to indicate a generalized vasomotor inactivity.

Most illuminating, however, are the comparative results obtained by examinations of patients suffering from languor cardis before and after exercise. These, combined with similar details from a series of control cases, furnish a valuable basis on which not only the present state but also the prognosis can be founded.

The resting rate of the heart is rapid, and in this respect languor cardis differs from the other main varieties of heart disorder which soldiers are prone to develop. The average rate at rest[1] of forty consecutive cases was ninety-six.

[1] The resting rate here referred to is the heart's rate taken after thirty minutes' rest in the recumbent position.

This resting rate is subject to abnormal acceleration when the erect position is assumed. The average increase in the same series of cases was nineteen beats per minute, and from controls we know that this figure is approximately double what it should be in the healthy state.

A series of carefully chosen test exercises, which will be more fully explained at a later stage of the paper, are employed to determine the patient's reaction to exercise and work of a physical character. It is, however, not considered sufficient to rely solely upon the results obtained from these tests; though very frequently it is possible to form an opinion of an adverse character by reason of the excessive tachycardia which the exercise produces, the abnormally lengthened period before the pulse-rate declines, the exaggerated and prolonged rise of the systolic blood-pressure and the more general signs of distress, such for instance as dyspnœa, perspiration, giddiness, etc., it is found practically that to rely solely upon the results of test exercises, when endeavouring to establish the fitness or otherwise of a man for military duties, is fallacious. The heart's immediate response to muscular exertion is important, but of equal moment is its power of endurance. This latter can be determined by careful examination following rather more protracted and lengthened physical exercise than can be performed in the medical inspection room. One must start with a clear understanding of the man's so-called resting state, and then proceed to investigate, by observation and examination, his condition on the parade ground, after physical drill, route marches, games, etc. By such methods we can reasonably form a satisfactory estimate of the heart's capabilities, and, relying mainly upon physical signs, rather than upon symptoms, one can without difficulty arrive at conclusions sufficiently definite to allow of an exact prognosis and classification from the military point of view.

Group V.—Comments regarding the series of cases here for consideration need only be brief.

Firstly, it is important to thoroughly appreciate that the group itself offers important and tangible evidence against the careless and wanton usage of the unfortunate title "D.A.H." Genuine shell concussion has, as we know, a widespread and complex variety of results. Symptoms abound and express the universal character of the system derangement. There is, however, appreciable reason for this extensive symptom complex, in that the central nervous system which governs and presides over the phases and functions of the various viscera, controls the size of the vessels, enervates the muscles, skin, and all the organs of special sense, is itself undergoing a functional disturbance.

Primarily, therefore, every genuine case of shell concussion is indicative of nervous system mischief, and all the phenomena which ensue are but secondary results of the same. Of these latter complications, the cardiac are without doubt prominent both objectively and subjectively. They appear, moreover, both in the severe and in the mild types of case and quite

irrespective of the actual causative factor, whether it be one severe shock or the summation of several. It is, however, highly important to remember that heart symptoms are capable of exaggeration, and evince extreme obstinacy, especially if, for instance, the general, moral and physical tone be below par. One cannot fail to notice, in fact, that the patients which compose this group, those men whose debility arises as a direct sequence of shell concussion, divide themselves from the commencement of their treatment into two well and clearly defined classes: (1) Those who intend and endeavour to improve, and (2) those who do not expect to recover.

Unfortunately the latter class of case is relatively common. One has but to see the types of patients who crowd the hospitals and bases suffering from the effects of shell concussion. The diagnosis varies, shell-shock, concussion (buried), neurasthenia, D.A.H., nervous debility, etc., apparently depending upon the most prominent symptoms. But it is important to notice that these diagnoses describe identical conditions. The patient is the same in all cases. Progress towards recovery is rapid and uneventful in those whose ultimate cure is effected; but the large majority of these patients are sources of dissatisfaction; the symptoms maintain an extreme degree of obstinacy; more especially, in fact, does this apply to those whose condition is aggravated by cardiac complications, for there is no doubt that the latter, once produced, are, for a variety of reasons, remarkably resistant to all forms of treatment.

The following notes of two illustrative cases offer what may be looked upon as characteristic details:—

Case 1.—Pte. C. J. R., aged 24; buried and concussed by the explosion of a shell on February 18, 1917. Not unconscious; treated in hospital for six weeks, then transferred to convalescent depot. On arrival at the latter it was noted that the man, who in civil life had been a bank clerk, was anæmic, pale, and of poor physique. The symptoms complained of were pain in the left side of the chest, daily headaches, palpitation, and insomnia. The physical signs included tachycardia (the heart's rate resting was 116); an extensive and forcible apex beat, a loud first sound, a diminution of the diastolic period, a pulse regular in rhythm, but low in tension and poor in volume, and a general hyperirritability of the nervous system shown by the presence of tremors and the exaggerated reflex response; the systolic blood-pressure was 100 mm. Hg; the pulse pressure 25 mm. Hg; response to test exercises was poor, the pulse rate was accelerated abnormally, and both it and the raised pressure returned to their respective figures only after an unduly lengthy interval. The patient was put under treatment, observed at exercise, and examined every third day. No progress was noted until fifteen days had elapsed; the patient then volunteered the statement that his palpitation was less and that he was not sleeping so badly as he had been; but he still complained of pains in the chest and severe headaches. His apex beat remained forcible in character, but the resting rate was at a lower level and the response to

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exercise was more satisfactory. The limit of his progress seemed to have been reached, however, for during the following fortnight all the original symptoms returned, others were added. Response to effort, though improved, did not reach the normal limits, and the patient was discharged to his base for reclassification.

Case 2.—Pte. P. J., aged 29, in civil life a milkman by trade, who had at no time indulged in athletic amusements of any kind. Was evacuated from his unit to hospital in April, 1917, suffering from the effects of shell concussion.

Having undergone treatment, patient was returned to his unit in July, but remained only one month. The symptoms returned and he had again to be admitted to hospital. Examined on September 2, patient was complaining of shortness of breath, nocturnal palpitation, dizziness and a gripping pain in the chest. The general development was under the average, and it was noted at the time of the examination that perspiration was excessive, while the general attitude was one of restlessness and nervous irritability. Physical signs included a rapid pulse of low tension (110 mm. Hg), a forcible and diffuse apex beat with its maximum impulse in the fifth intercostal space immediately below the nipple, a diastolic shock over the pulmonary area, an undue loudness of the first sound at the apical region, and well-marked respiratory irregularity of the heart's rhythms. There was no hyperæsthesia of the chest wall; the lungs presented no abnormal physical signs; the reflexes were abnormally brisk; response to effort was poor; progress was unsatisfactory; the neurasthenic condition persisted, symptoms of exhaustion, both cardiac and general, were observed to arise prematurely during the routine convalescent treatment which was adopted, and it became evident that patient was unlikely to recover sufficiently for full duty with his unit. He was therefore evacuated to his base for reclassification.

These two cases are but types representative of the class of man who most readily falls victim to the effects of prolonged shell fire, concussion, etc. Without attempting to infer lack of stamina in every case, and admitting that the etiological factors do frequently assume an extreme limit of severity, one rapidly realizes the type of individual who succumbs mentally and physically by reason of the effects, both immediate and remote, which associate themselves with the varying degrees of shell concussion. The mental attitude is distorted, the moral tone is lowered. and the patients appear to develop an introspective state of mind, worrying as to the significance of small and trifling symptoms, thinking and brooding for hours over their recent experiences, disturbed with regard to the future and what may be their fate if they recover. Quite apart from treatment, one is perfectly convinced that the less these particular patients know about their condition, chances of recovery, etc., the better will be the result; and there can be no doubt that it is utter folly to label such cases symptomatically. This latter applies more especially in those patients

who develop some one or other cardiac complication. In fact no variety of case exists which illustrates to greater advantage the abuse of a faulty terminology. To diagnose them D.A.H. is in most cases quite erroneous and always unfortunate, for by so doing we directly prompt and encourage the patients to focus mentally upon the heart and its actions. This naturally is the very last and quite the worst of all possible events; as in other instances of functional disease, it is invariably a mistaken policy to acquaint these patients with anything more than very superficial details. To inform them that they are suffering from D.A.H. is simply courting trouble and disaster, frequently aggravates the general state and always delays both progress and ultimate cure.

Group VI.—This, the rheumatic group, includes all the cases whose condition can be definitely connected with previous rheumatic fever.

Broadly analysed, one cannot fail to be struck by the very low percentage of cures in this group, and it can be accepted as a very fair working axiom that any man who has previously suffered from rheumatic fever and develops cardiac symptoms on active service, is unlikely to become fit enough to return to full duty.

Often enough some degree of distress is complained of during the early stages of training, but whether this be so or not one cannot fail to be struck by the short length of time which these patients have spent with their units before the onset of symptoms necessitating evacuation. It frequently happens that men drafted overseas do not get beyond their base, and those who do reach their units remain for a very short period, often a matter of weeks or, at the outside, months. The worst of these cases pass from hospital back overseas. It is not of these that one is here treating. The present group is composed of men whom convalescence will benefit in varying degree, possibly sufficiently so for them to be able to carry on useful work in a suitable and lower category. It is these men whose period of active service can be reckoned in months. The average period served by forty consecutive cases in this group was six and a half months before symptoms became sufficiently severe to warrant evacuation. So that one can soon realize, remembering the more serious hospital cases, that the average *military value* of a man who has had rheumatic fever is very short and inefficient from the active service point of view.

The symptoms do not differ from those which characterize the other groups to which reference has already been made, hence do not necessitate further discussion beyond an observation upon the striking frequency with which hyperalgesia and thoracic pains are noted upon the history sheets.

Physical signs of dilatation, and murmurs resulting from this condition, are common, and in numerous cases valvular incompetence, indicative of organic disease, is manifest; premature beats are the rule. The response to exercise is poor and effort is badly borne. Tests from the point of view of the heart's response to exertion and endurance tend but to confirm the opinion which is formulated by experience, viz., that the reserve power of

the heart after rheumatic fever is unlikely to be high enough in actual value to withstand satisfactorily the strain of full duty on active service.

Group VII.—This, the last group of the series, includes ninety-five cases in which the diagnosis "D.A.H." is, if possible, more unfortunate and less correct than in any of the above-mentioned types.

With few exceptions, an acceleration of rhythm, or an occasional premature beat, constitute the sole cardiac physical signs, and it is both wrong and wantonly fallacious to apply to these patients any diagnosis which may indicate heart mischief, when, as we shall see later, the primary disturbance is manifestly not cardiac but dependent upon some one of several morbid conditions which not only induce but also maintain in varying degree their own characteristic signs and symptoms, and further involve the entire system in a state of general debility which the heart rapidly reflects and brings into relief both subjectively and objectively.

It is certainly not the writer's intention to deny that there is an alteration in rhythm or cardiac response in certain of the cases which compose this group, but rather to lay stress upon the fact that no pains should be spared which may aid the elucidation of the primary disorder, so as to obviate as far as possible anything in the shape of a symptomatic diagnosis. The following sub-groups indicate the headings into which Group VII automatically divides:—

(*a*) Dyspepsia (nine cases). Generally heralded by pains in the lower præcordium, described by the patients as being "round the heart." Worse at nights and also after food; associated with flatulence, frequent pain, fullness in the chest, a heavily coated tongue and shortness of breath; always improved, if not cured, by dietary regulations and stomachics. The teeth and gums are examined as a routine, and treated as may be necessary.

(*b*) Bronchitis (thirty-two cases). Signs and symptoms expressive of the gravity of the primary lesion and demonstrating in able fashion the closely related spheres of activity which obtain between the thoracic viscera. The possible presence of tubercular mischief should always be considered, and great care must be exercised that the patient is not sent from hospital before convalescence has definitely commenced.

(*c*) Pneumonia (fifteen cases). The cause and incapacitating effects were in these cases always apparent. Discomfort and inability for lengthy exertion were accounted for in three instances by imperfect resolution, in others by a deficiency of air entry at the seat of the primary lesion and a reduction in oxygenating areas. Quite frequently the pneumonia had occurred several years previously, but recovery had not been satisfactory. The patients stated that they were never the same after their attack. In some instances change of occupation became necessary owing not only to the bronchitic tendency but also to the lowered power of resistance. Of this sub-group those patients who did recover were strong well-built men who, previous to the war, had been employed at work of a laborious type, miners, general labourers, blacksmiths, etc.

(*d*) Malaria (eight cases). These patients were all perfectly frank cases of malaria. They had the numerous symptoms but none of the physical signs of heart disease.

(*e*) Pleurisy (six cases). Under this heading are grouped all those patients in whom physical signs of past pleurisy were clearly defined. These latter include among their number certain phenomena which indicate that the heart has not entirely escaped participation in the early stages of the pleural inflammation; the pericardial membranes, being prone to share any morbid state which the adjoining pleura may exhibit, tend later to form adhesions in various directions. We therefore recognize the presence of an adherent pericardium. We notice that the apex beat is immobile with change of position, that the area of cardiac dullness is unchanged during the alternate phases of respiration, and that, in certain areas, there is well-marked retraction with the heart's systole. These and other physical signs which need not here be noted, point to the presence of a permanent, and, in the truest sense of the word, functional handicap to the mechanism of the heart. Quite apart from the possibility of dormant tubercle, it is perfectly reasonable to understand that definite pleural adhesions, involving the mediastinum and the pericardium, are not compatible with ability for well sustained effort. Every case must be judged upon its own merits, and the heart's reserve of power will need a very careful estimation.

(*f*) Tobacco poisoning (one case). Fortunately the cases in this subgroup are few, and with ordinary treatment they all recovered satisfactorily. The symptoms complained of were: Palpitation, shortness of breath, fainting attacks, dizziness, excessive perspiration, nervousness, tremors, headaches, and indigestion. Tachycardia was always noted; and the blood-pressure was subnormal in every case. Abstention from tobacco was, as far as possible, rigidly enforced during the treatment.

(*g*) Enteric fever (seventeen cases). The patients under this heading divide simply; those who recovered complained of a variety of symptoms indicating general debility. This they ascribed to some previous attack of typhoid fever. The heart presented no sign of disease; its action was that of any ordinary convalescing patient. Those who did not recover sufficiently for full duty presented some form of cardiac failure, either a valvular incompetence, some degree of dilatation, or an impoverished response to exercise.

(*h*) Dysentery (seven cases). In all these cases the exciting cause had obviously been the bowel infection, for the previous health had been perfectly good. The cases on the whole did badly (three became fit). The majority did not improve; dilatation and myocardial enfeeblement were obvious, the response to effort was abnormally poor and the blood-pressure readings were eloquent of the low quality of the heart muscle and its ill-sustained efforts to maintain a satisfactory head of pressure.

Prognosis.—Judging by the figures which appear in the main table at

the early part of this paper, one cannot fail to be struck by the low percentage of cases in whom complete recovery ensues. Furthermore, one is forced to assert and accept the following fact, that war diseases are complicated by a variety of heart disturbances which do not readily yield to treatment, and that latent disease of the heart itself which existed, but was suitably combated in civil life, assumes, with active service conditions, all the usual features which one associates with incapacity of cardiac origin.

Dismissing, for the time being, the cases of actual disease, and considering only those cases of functional disturbance which arise to complicate recovery from some one of the conditions previously mentioned, it is perhaps advisable here to add a note which will make clear the reason for the apparently small number of cures obtained.

Experience proves that the most efficient plan to adopt in dealing with the heart disorders of soldiers is to commence a carefully organized convalescence at as early a date as possible. But one word of warning is here necessary. This course of treatment, which will be more fully discussed at a later stage, must not be indefinite in time. An average period of two months is found to be a satisfactory working maximum. Cases not fit for full duty at the end of this time are, as a rule, perfectly capable of performing the employment specified in some one of the lower classifications at present obtaining; and it is very advisable that those patients whose cure is delayed for some reason be transferred to a suitable category, for, by so doing, we avoid the stagnating influence of an indefinite convalescence, and, moreover, we hasten the ultimate recovery and strengthen both the moral tone and the physical condition. Convalescence, therefore, in large numbers of cases, may be looked upon as the preliminary step, and suitably chosen work as the intermediate stage leading to final cure and a return to full duty.

In regard more especially to the question of prognosis, of which we are at the moment dealing, it is essential carefully to weigh up and consider a chain of evidence somewhat complicated in that so many are the details requiring attention.

It is imperative, obviously, that full and careful notes be taken of every case. The following details should appear:—

The number, name, and unit of the patient; his age, length of service, and occupation in civil life; his previous history in regard to illness, and his habits; a minute history of the present illness, its onset, symptoms and progress (leading questions should not be asked).

The physical examination should be general and complete, not entirely devoted to the vascular system, though one as a rule finds it necessary to pay special attention to this in order that we may provide ourselves with concise notes on which to rely for the basis of an opinion later in regard to the progress made and the correct disposal of the cases.

The cardiac dullness should be mapped out with light percussion and

the apex beat located; the extent of the latter must be noted, also the real tenderness in this region which is proved by the involuntary flinching the patient exhibits on palpitation and percussion.

It is well always to note the length of the diastolic interval, the pulse respiration-ratio, the occasional presence of an enlarged thyroid gland, and excessive perspiration if this be present.

The heart sounds must be examined with all possible precision, both in the erect and recumbent postures.

The heart's rate (resting) is taken before proceeding to the second part of the examination which involves an investigation of the effects of exercise on the cardiac mechanism.

This is without doubt the most essential and important phase of the examination, for the following reason: every case of soldier's heart is characterized broadly speaking by the discrepancy between the numbers of the physical signs which obtain in relation to the abundance of the symptoms, and in forming a prognosis one finds it essential to weigh up these signs and symptoms and endeavour to balance them accurately with the tangible evidence which is afforded us by the usage of simple effort tests.

These latter may take a variety of different forms; in fact, it is immaterial what we adopt as a test; all one requires is some definite muscular exercise and a knowledge of the effects which it produces in the normal healthy man. The actual details which one depends upon and utilizes, when seeking information from effort tests, are furnished by the several records which together comprise a table comparative of: (1) The heart rate; (2) the respiratory rate, and (3) the blood-pressure, before and at a certain definite interval after the exercise is finished.

Very valuable evidence is thus forthcoming of the behaviour of the myocardium in its relation to activity, and it is obvious that the question of prognosis is simplified, especially if we combine results such as these with careful and minute examinations following definitely prescribed periods of physical exercise, drill, marching, etc. These results should be most carefully taken and recorded so that one may be in a position to estimate the value of treatment, not only from the actual state of the patient, but also from the tabulated series of effort test results.

The particular exercise which the writer has used and found not only quite simple but perfectly efficient, consists of two parts; first, an arm exercise is performed, and secondly the patient ascends a staircase carrying in his hand a known weight. A series of fit men were examined with this test in order to establish the necessary control values; the preliminary details were noted; the exercise was then performed. Two minutes later the heart-rate and that of the respiration were recorded, and after a further interval of three minutes the blood-pressure was again estimated. From these control experiments one can formulate, with perfect accuracy, a series of facts whose value from the point of view of the heart's response to effort is of supreme importance.

Thus we find all the details which together are considered sufficient to indicate the reaction of the normal heart to exertion.

The immediate effects of the exercise include an acceleration of the rates of both respiration and heart-beat combined with an increase in blood pressure. These alterations are, however, of a temporary nature only. After resting for two minutes, the normal individual is breathing at the same rate as he was previous to the execution of the test; the heart-rate is found to be less constant; with this particular test an acceleration of rhythm is frequently noted when the rate is recorded two minutes after the cessation of the exercise. More often than not this acceleration is one of a few beats only, possibly seven or eight; in other instances the original rate is found to have returned, but in certain individuals, more especially those whose normal rate of beat is comparatively slow, the acceleration may reach one of even sixteen beats in excess of the resting rate. For practical purposes one must therefore allow a certain range of acceleration as being an event of normal occurrence. The whole position may be briefly summarized. The control performs the test, the heart-beat two minutes later has returned, or is within twelve to fourteen beats of the original rate, and in any case is normal after a further two minutes.

The question of the reaction of blood-pressure as affecting the normal healthy individual is next for discussion. It is found that, following the test, the pressure rises immediately some 5 to 10 mm. Hg, and returns to its original figure at the end of five minutes. The pulse pressure shows an equally marked variation. We have, therefore, in the matter of the blood-pressure, and equally also from the point of view of respiration rate and heart-beat, a series of facts upon which it is possible to establish a reliable standard between the conditions of health and disease.

Patients suffering from functional disorder of the heart manifest in varying degree an exaggerated response to effort. The respiration rate is increased and remains so abnormally long, even in spite of the fact that it is so frequently unduly rapid even in the resting condition. The heart-rate, as a rule rapid before the exercise and during resting intervals, exhibits an increase in rate, not only excessive in amount, but one, moreover, whose return to the normal is unduly delayed.

The accompanying table is prepared from the notes of 100 consecutive cases of the series, and illustrates typically the effects of the preliminary test performed on admission :—

	Heart		Respiration	
	Before test exercise	Two minutes after test exercise	Before test exercise	Two minutes after test exercise
Average rate	98	—	25	—
,, increase	—	19	—	8
Maximum rate observed	152	—	44	—
,, increase observed	—	36	—	24
Minimum rate observed	60	—	16	—
,, increase observed	—	4	—	0

The blood-pressure observed in patients prior to the test exercise is, as a rule, perfectly normal. The subsequent reaction, however, reveals numerous interesting details. In the large majority of patients, those especially whose condition is purely functional in character, the rise in pressure which follows the exercise is exaggerated, and, moreover, abnormally persistent in that the decline to the original figure is delayed. It does, however, happen that certain patients manifest an entire absence of rise in blood-pressure reactionary to exercise. This may be taken to indicate some form of myocardial insufficiency and is invariably confirmed by the co-existing signs and symptoms.

The exaggeration of the rise in blood-pressure, and the delay in its return to the original level following the exercise test, can best be illustrated by the average figures noted in a series of typical cases. For this purpose the notes of 100 cases have been analysed, and it is found that the average rise, immediately after the test, was 18 mm. Hg, and that the average of the prolonged rise, that is to say, the rise still observed after five minutes interval, was 8·4 mm. Hg. Hence we have a very definite degree of difference in the manometric readings of patients and controls. It was noted that in the case of the latter the pressure was invariably normal five minutes after the conclusion of the test. This is not so in patients with functional heart disturbance. The blood-pressure returns in tardy fashion; the maximum increase noted in the series was one of 25 mm. Hg, the minimum 2 mm. Hg, and the average as mentioned above was 8·4 mm. Hg.

Details then of great value therefore can be acquired by the usage of test exercises, and it is impossible to form any satisfactory opinion without them. But it is to be clearly understood that they do not constitute our sole source of information. They, so to speak, take their part in the investigation and frequently assist us very materially both from the points of view of diagnosis and prognosis. But it is very essential that before arriving at any conclusion we collect and consider each and every factor which may help us to form a satisfactory opinion; the age of the patient, his previous occupation, his length of service and past history will all possess an important bearing upon the matter of prognosis. Equally also must one consider the unit to which he belongs in order to exercise a cautious discrimination between the values of fitness which the various ranks and units relatively demand. For example, a man perfectly fit for full duty with a Labour Company need not reach the standard of fitness required by the infantryman. As mentioned above, an effort test should be carried out and the physical condition resulting must be observed, and signs of distress, if any be evoked, should be noted. In addition, one must frequently examine the state of affairs which is brought about by exercises of a more protracted nature, such, for instance, as physical drill, in some of its many forms, marching, games, etc. These examinations should be performed frequently, and it is advisable that they assume the type of a

general inspection rather than that of a special inquiry into the heart's condition. One finds, moreover, in treating functional disorders of the heart, that the general physical condition needs to be watched very closely, for one realizes how intimate is its association not only with the activities of the heart but also with the entire mental attitude and outlook.

In conclusion, a list is appended of the more important signs which, when persisting, indicate lack of recovery:—

(*a*) Persistent tachycardia, rates of 120 and over at rest.

(*b*) Breathlessness on exertion tested objectively.

(*c*) Persistent pain, especially if its existence be proved satisfactorily by the presence of definite areas of hyperalgesia or true and involuntary flinching when the apical region is palpated or percussed.

(*d*) A poor response by the heart to change of position, giddiness and tachycardia following the adoption of the erect position from the recumbent.

(*e*) Premature beats in certain cases, especially if they only appear after exercise and are entirely absent in the resting state.

(*f*) A diminution in the diastolic interval, especially if this be continuously observed during the resting phases.

(*g*) Excessive perspiration in the absence of exertion.

(*h*) Continual dislocation of the pulse-respiration ratio.

(*i*) Obvious distress brought on by exercise, testified to not only by the symptoms above mentioned but also by fainting attacks, cyanosis, pallor and abnormal activity of the alæ nasi.

These signs and symptoms are, so to speak, of ill-omen, and if persisting, they certainly debar the patient from full duty, and the question arises as to which category he shall be put into. In this matter every case must be judged upon its own merits, as must also those cases in whom definite heart disease occurs. These latter, especially the rheumatic class, those with valvular disease, myocarditis, paroxysmal tachycardia, etc., can never recover sufficiently to undertake anything more arduous than work of a sedentary or the lightest possible character.

Those patients in whom symptoms and physical signs persist after two months' treatment, as, for instance, cases following trench fever, gassing, shell concussion, etc., become perfectly fit and usually tend to recover completely after they have been suitably employed at light duty for a further period of two to three months.

The whole matter of prognosis is undoubtedly one of extreme difficulty. One has so many details to take into consideration, but briefly it can be summed up as follows:—

One should treat the heart as an ordinary muscle, and, starting with a definite knowledge not only of the capabilities of the normal heart, but also of the type of physical work which a soldier on active service in modern warfare has to perform, endeavour to elucidate by every method in our power the response on the part of the patient who suffers from some one

of the various forms of heart disturbance which one knows nowadays by the unfortunate term "D.A.H."

Treatment.—Convalescent treatment of patients suffering from functional disorders of the heart can only achieve success if we adhere rigidly to rational methods. One must primarily realize that, more often than not, the problem with which we are faced is one of a general rather than a localized and special derangement. The heart, unfortunately, is an organ which is capable of expressing in a subjective manner an untold multitude of widely differing states and conditions, and treatment, to be successful, should be on general rather than special lines. One is, moreover, convinced that these heart patients should not be separated, either from the point of view of institution or treatment, from other convalescents. In other words, "herding" is to be deprecated, and collective treatment enjoined, so that the tendency to become introspective and even morbidly apprehensive, which results from a close inter-relationship between subjects whose chief malady is neurotic by nature, may be met by the valuable counteracting effect of the presence and society of others whose mental attitude and general outlook may be more hopeful in character.

During the preliminary days of convalescence it is our principal endeavour, partly by examination and partly by the due appreciation of the results brought about by treatment, to decide definitely and quickly which patients will recover and become fit for full duty with their units, so that those in whom the prognosis is unfavourable may be drafted without delay for such suitable employment as their condition may allow. Indirectly, in other words, we arrange that, during the convalescent treatment, an automatic sorting process shall take place, actual disease being eliminated at once, and, similarly, all types proving obstinate and resistant to treatment, as soon as one is satisfied that complete recovery will not ensue within a reasonable period.

During the initial stages one must pay special attention not only to every complaint which the patient may offer, but further, one must make an exhaustive search for the possible presence of any factor which may retard recovery. Errors of digestion should be corrected, the teeth inspected with care, and every effort must be made to promote the highest standard of personal hygiene that is reasonably possible.

In regard more especially to the essentials of treatment, one learns by experience that two qualities must always apply, viz., employment and properly regulated activity of both brain and muscular system, together with the patient's whole-hearted efforts if these latter can be satisfactorily enlisted.

From the outset it should be the chief object of the medical officer to gain the entire confidence of the patient, and in so doing he will of necessity be called upon to display both tact and sympathy in reasonable amount. The cases vary to such an enormous extent that each requires most careful investigation and advice.

Physical exercise, graduated in character, is regarded as the backbone of the actual treatment. This must be performed under the guidance of skilled and expert instructors, and supervised by a medical officer who, himself, should have a thorough and complete knowledge of the detail and technique of the drill from the practical point of view, so that he may fully appreciate not only the effects of the individual exercises, but also the difficulties, apparent or real, of which the patient may complain.

The practice adopted by the writer consists of a course of exercises so graduated that, by convenient stages, the patient eventually reaches and performs the drill laid down in the trained soldier's table. The drill takes place daily (Sundays excepted), and is performed, if the weather permits, in the open air; at other times in the gymnasium. The squads formed are as small as possible, so that the maximum of individual care and attention may be devoted to each patient, and include patients convalescing from all types of maladies; the heart cases must not be kept apart—the so-called "heart squad" is an unsatisfactory institution and to be deprecated.

The exercises are prescribed upon a carefully arranged plan and in a definitely graduated series, which latter is divided into three groups.

Group A, the elementary class, in which patients as a rule remain only three to four days. This series of exercises include a large number very specially directed towards the respiratory movements, and one moment's consideration clearly explains how beneficial these exercises must be in cases of disturbed heart action of the functional variety. We know that with the chest at rest in the expiratory position, the intra-thoracic pressure stands at, roughly, -5 mm. Hg, and that a full inspiration lowers the pressure in the thorax to -30 mm. Hg. Hence we see at once how very materially the venous flow may be aided, and the tendency to venous stagnation counteracted. Further, we know that, unlike the venous channels, the arteries are but little affected by pressure changes, and in consequence we can readily appreciate the reason for the increase of blood-pressure and arterial output during the inspiratory phase.

Group B, the intermediate class, and Group C, the final class, each differ from Class A and from one another in that, as can be seen from the detailed list given below, the exercises of which they are composed follow a scale of increasing severity, so arranged that at the termination of the treatment the patient is performing exercises similar to those prescribed for normal healthy soldiers who have not recently undergone a course of physical training.

Class "A" (thirty minutes).

Heels raising.
Heels raising and knees bending.
Head backward bend.
Breathing exercise.
Foot placing outwards.
Feet close and full open.
Breathing exercise.
Arms raising sideways and upwards.

Head turning (slowly).
Marching (to a given step).
Breathing exercise.
Foot placing sideways.
Arms lowering sideways and downwards.
Feet close. Heels raise.
Breathing exercise.

Class "B" (thirty minutes).

Hips firm, heels raise, knees bend.
Hips firm, heels raise, knees bend (quickly).
Head turning (slowly).
Breathing exercise.
Arms forward, sideways, and upward stretch.
Breathing exercise.
Foot placing sideways (continuous).
Breathing exercise.
Head backward bend.
Feet astride, arms upward stretch.
Hips firm, leg raising, forward, sideways, and backwards.
Feet closed, hips firm, trunk bending sideways.
Breathing exercise.
Hips firm, left foot sideways place, trunk backward bend.
Breathing exercise.
Hips firm, left foot sideways place, trunk forward bend.
Breathing exercise.
Marching on the toes, marking time with knees raising.
Slow march.
Feet closed, feet open, heels raise.
Head backward bend.
Heels raising and lowering quickly.
Breathing exercise.

Class "C" (thirty minutes).

Arms bend, heels raise, knees bend, arms stretching sideways (four times).

Head backward bend (three times).

Arms bend, arms stretching sideways, upwards and forwards (three times, varying sequence of direction).

Arms bend, foot sideways place, trunk turning (three times in each direction).

Hips firm, foot placing sideways with heels raising (six times each foot).

Feet astride, arms sideways stretch, trunk backward bend (four times).

Feet astride, hips firm, trunk bending forward and full downward (twice).

Hips firm, leg raising sideways (three times each leg).

Leg raising forward, sideways, and backwards (once each leg).

Arms bend, foot sideways place, trunk bending sideways quickly (four times each side).

On the hands down, arms bend, on to one hand turn (twice on each); or (ground permitting) lying on back, leg raising.

Arms bend, foot sideways place, trunk forward bend, arms stretching sideways (three times).

Quick march, double march.

Marching on toes.

Marching with knees raising.

Hopping on alternate feet.

Sideways marching.

Heels raising and knees bending (four times).

Arms raising forward and upward, lowering sideways and downwards (four times).

Combined with the exercises, and incidentally to avoid monotony, certain games are introduced into the daily physical training table. These must be conducted with every energy and the strict observance of all prescribed details. These games include :—

(1) Jumping the bag.
(2) Simple relay race.
(3) Three deep.
(4) "Under passing" relay race.
(5) "Whip to the gap."
(6) Changing places.
(7) Circle touch ball.
(8) Medicine ball.
(9) Hand ball.

The maximum time devoted to games should not exceed ten minutes; their value depends not so much upon the physical effort as upon the fact that, smartly executed, they inculcate discipline and develop quickness and rapidity between the co-ordination of brain and movement.

The physical training laid down in the above tables is supplemented by route marches, and all forms of outdoor games are strongly encouraged. Under all the various conditions of physical exercise the patients should be watched very closely, especially during the early period of their treatment; but intricate examinations are not to be advised as a regular event. In fact the less obvious attention one pays to the circulatory system, after first ascertaining the existing state of affairs, the better undoubtedly is the outlook. One can, by the use of ordinary caution and tact, easily elicit the symptoms existing and examine the physical signs which may be present without the use of leading questions, and without alarming the patient or making him unduly suspicious.

It must be patent to all concerned in the treatment of heart disorders which arise in soldiers, that the main part of the therapy, which is found by experience to be attended by the best results, is properly organized and graduated training, but, as one would expect, this does not comprise our sole remedial agency.

Certain of the symptoms can be relieved by the judicious use of drugs. Mild tonics containing iron and arsenic are usually appropriate, as in other instances of convalescing patients, and, quite apart from their recuperative qualities, it may be stated as a general rule that the so-called "placebo" mixture is of extreme value in the majority of the "D.A.H." types.

Should the symptoms be of very recent onset, exaggerated in degree, or suddenly aggravated, a short rest from the exercises is indicated, but except in very special circumstances, it is not considered wise to keep the patient in bed.

Tachycardia is frequent and extremely obstinate, in fact the most troublesome of all the physical signs, and the palpitation which more often than not coexists is, to the patient, a continual source of worry and alarm.

It is advisable to supplement the general treatment in such circumstances, and endeavour by all the means in our power to control the excessive rapidity of the cardiac action. Digitalis and strophanthus are obviously useless and should not be prescribed. One achieves the desired end very frequently by the exhibition of bromides combined with either quinine or nux vomica. Such a formula as the following has proved itself very valuable:—

Pot. brom.	..	..	..	..	gr. xv
Tr. nucis vom.	..	..	..	..	♏vii
Liq. arsenicalis	..	..	..	..	♏ii
Tr. zingib.	..	..	..	..	♏x
Aq. dest.					

It is good practice also to see the effect of the application of blisters to the vagi, both nerves being treated thus with a succession of small blisters in their cervical course.

Nocturnal palpitation calls for the use of some sedative at bed time and it is well to combine this with a sound tonic during the day. Chloral hydrate with bromides, or paraldehyde, in small doses, seem to be the most satisfactory of the sedative drugs. The tenderness which develops in the apical region after prolonged tachycardia responds to the effects produced by the application of a mustard plaster, which should be kept on for one hour. In aggravated shell concussion one frequently needs to prescribe for the extreme nerve irritability which is so often the most important feature of the malady. Undoubtedly our best plan is to keep the patient occupied, both with the ordinarily prescribed exercises, marches, etc., and in his spare time to encourage reading and games of all kinds, not only out of doors, but also the quieter forms of amusement as provided by draughts, chess, patience, puzzles, etc., and in addition to prescribe a nervine sedative mixture, such for instance as one containing valerian with bromide, and at bedtime, if absolutely necessary, a small dose of trional or chloral hydrate.

The question of smoking is always important. Cure is certainly delayed by excess in this habit, and yet it is obviously patent that, considering the types and classes which go to make up and swell the ranks of those who suffer from the heart disorder peculiar to soldiers, one can make but little impression on such patients as a general rule. It is in fact the exception to find men who will even endeavour during their convalescence to hasten their cure by moderating their smoking.

I have to thank Lieutenant-Colonel Moriarty, D.S.O., R.A.M.C., for permission to publish these notes, and for his valuable assistance in many of the details relating to the same.

PRELIMINARY REPORT ON THE PRESENCE OF A "FILTER PASSING" VIRUS IN CERTAIN DISEASES,

WITH ESPECIAL REFERENCE TO TRENCH FEVER, INFLUENZA, AND NEPHRITIS.

By MAJOR-GENERAL SIR JOHN ROSE BRADFORD, K.C.M.G., C.B.
CAPTAIN E. F. BASHFORD.[1]
Royal Army Medical Corps.
AND
CAPTAIN J. A. WILSON.
Royal Army Medical Corps.

A Report presented to the Director-General Medical Services, British Armies in France.

DURING the autumn of 1917, and the spring and summer of 1918, observations were carried out by us on the pathology of acute infective polyneuritis. These resulted in the detection, isolation, and culture by the Noguchi method of an organism that reproduced the malady when inoculated into animals; and, further, this organism was recovered by culture from such experimental animals. The details of this work will be published in the forthcoming number of the *Quarterly Journal of Medicine*, and therefore need not be considered here.

The causative organism of polyneuritis belongs to the group known as "filter passers," in that the virus will pass through certain filters, although it is not a filter passer in the sense that some other organisms are, as it does not pass through certain filters with very fine pores.

The satisfactory results obtained in the study of polyneuritis led naturally to the same method that had proved so successful with this disease being applied to other diseases where there was either evidence, or suspicion, that the causative agent was a filter passer. A considerable number of such diseases have been investigated on these lines during the last six months in the laboratories attached to certain hospitals in the Etaples area.

Captain J. A. Wilson conducted the whole of the bacteriological portion of these inquiries in the laboratory of No. 20 General Hospital. Further, the observations on trench fever mentioned below were all made in this hospital, and Major Frank Clayton, R.A.M.C., had charge of the clinical observations on the volunteers inoculated with the virus of trench fever.

Captain Peacock controlled the whole of the entomological part of the inquiry, and more especially the provision of clean lice to control observations on infected lice.

The experimental work on animals, and the histological work on the

[1] Captain Bashford took no part in the portion of this work dealing with trench fever.

lesions so produced, has been carried out by Captain Bashford in the special laboratory attached to the Observation Hut at No. 26 General Hospital. The present report is merely a preliminary statement as to certain results achieved; the full details—clinical, experimental, and histological—will be published later.

Trench fever was one of the first diseases examined at the suggestion of Captain Wilson. Other observers have adduced evidence showing that the virus of this disease belonged to the group of filter passers.

Trench Fever.

The virus isolated in trench fever consists of minute coccus-like bodies grouped in pairs, with the opposing surfaces flattened, and varying in size from 0·3 micron to 0·5 micron. It is Gram-positive and stains readily if the film preparations are washed in ether before the stain is applied. It passes through Berkefeld N and V filters, and also through Massen porcelain filters and can be cultivated from such filtrates. It resists heating to a temperature of 56° C. for thirty minutes, and it is an anaerobe.

This organism has been recovered by culture from the blood in 11 out of 15 cases of trench fever examined during the pyretic stage, and in 3 out of 8 cases examined when apyretic. It was not found in over 40 control cases where blood culture with the same technique was carried out. A similar organism was recovered from four separate supplies of infected louse excreta kindly supplied to us by Sir David Bruce.

It was not found in thirty-one specimens of excreta from batches of clean lice.

The culture obtained either from the blood of man, or from louse excreta, when inoculated by scarification into man, produces a mild illness, and the organism can be recovered from the blood by culture during such illness, and also from clean lice fed on the patient during the illness.

Influenza.

The virus isolated in cases of influenza consists of very minute rounded coccus-like bodies, varying from 0·15 micron to 0·5 micron. It is Gram-positive, and passes through Berkefeld N and V filters and Massen porcelain filter. It is an anaerobe, and resists heating to 56° C. for thirty minutes.

It has been isolated by culture from the blood in 6 out of 9 cases examined, from the sputum in 6 out of 6 examined, from pleural fluid in 4 out of 4 examined, and from the cerebro-spinal fluid in the only case so examined. It has also been isolated from the lymphatic glands post mortem in the only two cases examined. This organism can not only be grown from the blood, and from exudates, but it can also be

seen in stained films prepared from exudates—for example, sputum, pleural fluid, cerebro-spinal fluid.

The culture (second generation), when inoculated into animals subdurally or intravenously, produces illness in guinea-pigs and monkeys, and on post-mortem examination the following lesions have been found: Extensive lobular pneumonia with hæmorrhages, some nephritis, myocardial and hepatic lesions, such as extreme congestion, interstitial hæmorrhages of small size, and fatty degeneration. Passage experiments done from such animals when slightly ill, by injecting their blood, bile, etc., into healthy animals, causes in these more severe and even fatal illness, and post mortem the same lesions are found. The organism has been recovered by culture from the tissues of such experimental animals.

Nephritis.

Up to the present time (January, 1919) only one variety of nephritis has been investigated—that is, that characterized by the presence of pyrexia and hæmaturia at the onset.

The virus isolated in such cases of nephritis consists of a round coccus-like body varying from 0·3 micron to 0·6 micron in size, and in culture often occurring in the form of short chains of four individuals. The same organism may be seen in urinary sediments either singly or in pairs. It is Gram-positive, and passes through Berkefeld N and V filters, and also through the Massen porcelain filter. It is an anaerobe, and resists heating to 56° C. for thirty minutes.

It has been isolated from the blood in six out of nine cases examined, and from the urine in seven cases. The culture (second generation), when inoculated into animals, produces nephritis in monkeys and guinea-pigs. In monkeys this can be determined, not only by post-mortem examination, but also clinically, since the urine contains blood, albumin, and casts. In both guinea-pigs and monkeys extensive lesions, glomerular and tubular, are found on microscopic examination. In severe cases pulmonary lesions are also present.

The organism has been recovered by culture from the tissues of the animals experimentally inoculated.

These three diseases are those that have been most studied as yet, but organisms of the same group, although differing from one another, have been recovered by culture in a number of other diseases of obscure etiology. In most of these no adequate experimental work has been possible up to the present, and in others it is incomplete owing to insufficient time having elapsed to establish results with certainty. Among the more important diseases where true "filter passing" organisms have been isolated by culture from the blood, and seen in suitably stained films, mumps, measles, rose measles, and typhus may be mentioned. In mumps four cases have been examined, and all gave the same positive result.

Two cases of typhus have been examined, but as yet it has only been possible to get material from one each of measles and rose measles.

An organism allied apparently to that of polyneuritis has been isolated from brain tissue in cases of encephalitis lethargica, both from material obtained from England, and also from cases observed in the army in France. A considerable amount of histological work has been done on the lesions present in animals (monkeys) successfully inoculated with these cultures. These results will be published later.

If the organisms found in polyneuritis and encephalitis are excluded, all the others have many points in common and possibly belong to one group. Although exceedingly small, they present individual differences in their morphology and in their mode of growth in culture. These details must be reserved for fuller and later publication.

Clinical and other Notes.

FIRST-AID EXTENSION BRACE FOR USE WITH THOMAS SPLINTS.

By Captain (Temporary Major) O. HERBERT WILLIAMS.
Royal Army Medical Corps.

This brace is suggested for use with Thomas splints to overcome the difficulty of applying quick and efficient extension in the trenches and regimental aid post. It is intended for application over the boot.

Some of the Royal Army Medical Corps rank and file experience considerable difficulty in making the clove hitch and its application to the foot takes time and requires a considerable amount of manipulation and adjustment, all of which cause jarring of the limb and much pain and harm to the patient.

The brace is made of strong webbing (the webbing strap of a small box respiratory suits perfectly) in the form of two Ys, one of which lies on each side of the boot (fig. 1). The diverging limbs of the Ys merge into each other so as to form an anterior or dorsal strap in front of the ankle and a posterior or heel strap behind the ankle. The stem of each Y forms a loop to which an extension bandage can be fixed.

The brace applied appears as depicted in fig. 1. On one side it is made to fasten by means of a stud and stud slit to allow for the putting on and taking off (fig. 2). This is made of standard size and can be applied to either foot, the only difference being that when it is applied to the right foot the stud is on the inside and when applied to the left it is on the outside. It will adapt itself to any size or variety of boot.

Details of Construction.

Strong webbing 2 inches wide is used; it is cut into four pieces, two of which are 10 inches long and form the anterior and posterior straps, and two 12 inches long form the loops (fig. 3). The ends A of the anterior and posterior straps are sewn to each other at an angle of 90°, and the loop is sewn in such a way as to bisect this angle and form with each anterior and posterior strap an angle of 135° (fig. 4). Of the ends, B that of the anterior strap is sewn to one end of the loop at an angle of 135°, and that of the posterior strap to the other end of the loop at a similar angle.

A metal stud is placed at the anterior strap-loop junction and the corresponding stud slit is made at the posterior strap-loop junction. The stud slit must be in line with the loop strap.

Application of the Brace.

The appearance of the brace when it is unbuttoned is at first somewhat confusing, but if it is buttoned its mechanism is very obvious. In the first instance, then, it should be viewed buttoned, stud to the right of the holder, so as to ascertain which is the anterior strap.

To apply, unbuttoned, take hold of the stud between the finger and thumb of the right hand, thumb uppermost, and of the stitched strap-loop junction, in a similar manner, with the left hand. Lay the strap over the dorsum of the foot, allowing the remainder of the sling to fall towards the heel past the sole of the boot. Steady the stud with the left hand and take hold of the stud slit junction with the right hand. The heel strap is then drawn over the heel and buttoned off. Extension bandages are passed through the loops and extension made.

Fig. 1.

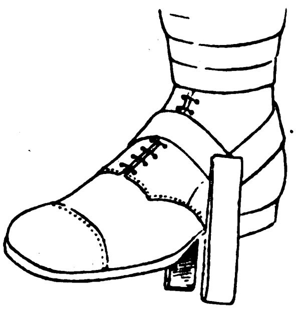
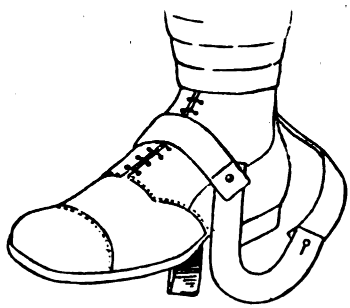


Fig. 2.



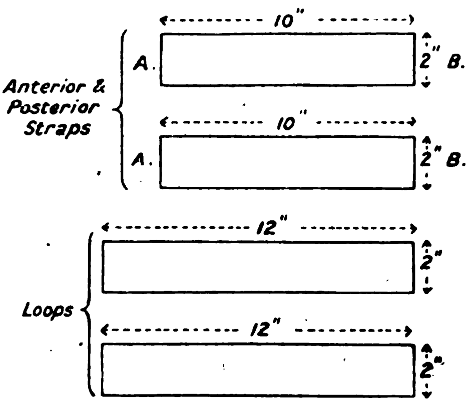


Fig. 3.

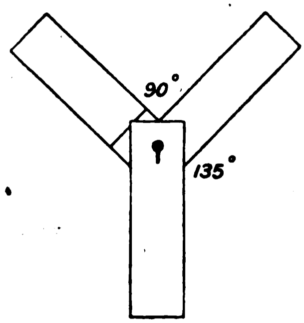


Fig. 4.

There is one important point to be noted. The assistant in making extension on the injured limb by hand while the brace is being applied, does so by grasping the ankle and not the anterior part of the foot and the heel. In this way the brace can be applied and adjusted without the manual extension being once relaxed and the brace extension replaces the hand extension without causing the patient any pain.

Advantages.

(1) The brace allows of strong and efficient extension being made with a minimum of discomfort.

(2) There is no possibility of it coming off as the greater the extending tension the tighter the grip.

(3) There is no constriction of the ankle or pressure on the malleoli.

(4) The foot is maintained at right angles.

(5) The extension is in the right direction, namely, in line with the limb from below the malleoli.

(6) It can be put in position in two seconds.

THE CURE OF INGUINAL HERNIA.

By Lieutenant-Colonel A. J. HULL.
Royal Army Medical Corps.

The high percentage of men who suffer from inguinal hernia has made the problem of their treatment a serious one during the present War. Trusses appear to be most unsatisfactory when used by soldiers. In my personal experience I have rarely seen a truss controlling the hernia. The truss appears to be worn for choice with the hernia unreduced. It may be stated that we regard an inguinal hernia as a congenital deformity due to the presence of an abnormal process of peritoneum. This defect is combined with a lesser acquired defect, namely, an abnormally long process of omentum, or more rarely mesentery. The

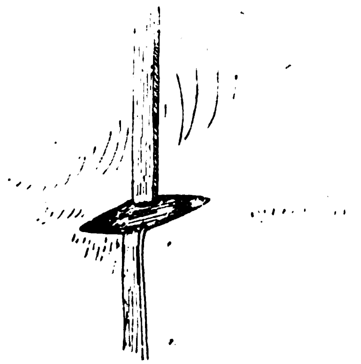


Fig. 1.—An incision about an inch in length has been made, half an inch above Poupart's ligament, over the femoral point. The fibres of the external oblique aponeurosis have been split for a short distance.

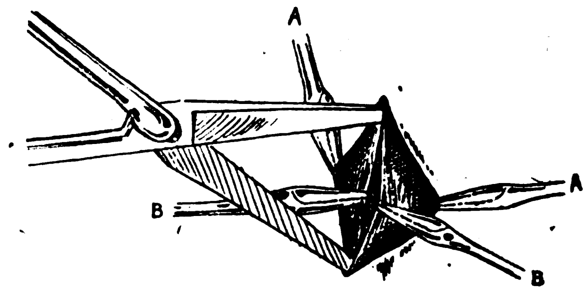


Fig. 2.—The edges of the aperture in the external oblique have been retracted by the forceps, A, exposing the coverings of the spermatic cord. The forceps, B, have been placed upon the aperture in the cremaster, which has been made by inserting the closed points of Mayo's scissors and opening the blades. The spermatic fascia is exposed in the depth of the wound.

treatment indicated appears to be abolition of the abnormal process of peritoneum and removal of the redundant omentum. The choice of an operation which will cure the hernia and render the man fit for service in the shortest possible time becomes desirable. Having had charge of a special department for the cure of hernia, dealing with cases at the rate of about 500 a year, the need for a simple operation giving adequate relief and followed by a rapid convalescence, has been impressed upon me. It occurred to me that much of the trouble following the operation for the radical cure of hernia, and many of the recurrences, were

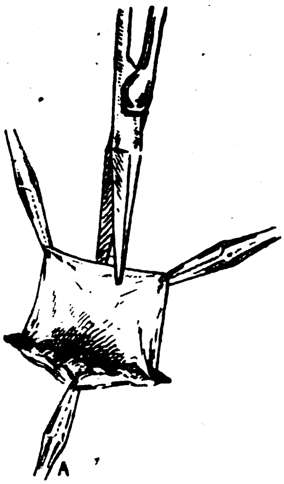


FIG. 3.—After incising the spermatic fascia the sac has been found and drawn out of the wound. The forceps, A, remain on the external oblique during the whole operation.

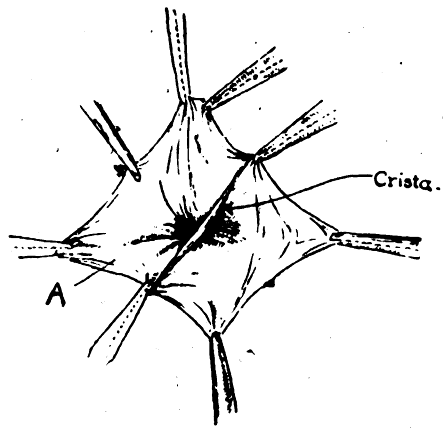


FIG. 4.—The sac has been opened and its aperture retracted by forceps, after having been enlarged by snipping the edges between the forceps. Two apertures are displayed divided by a process of peritoneum. The aperture A leads into the abdomen.

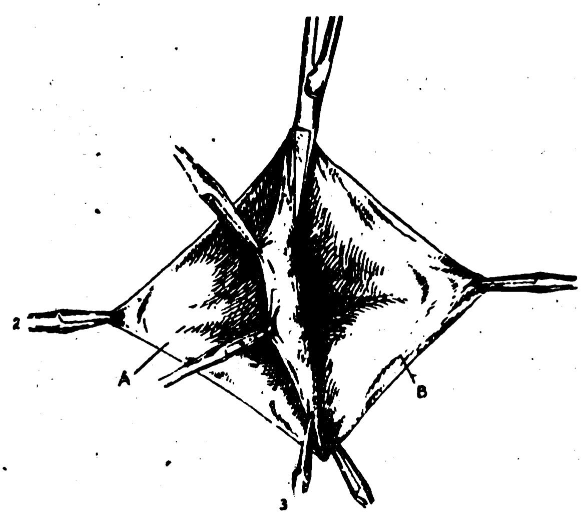


FIG. 5.—Forceps have been placed on the crista; a layer of peritoneum has been picked up on its mesial side and this layer is being cut with scissors. By lifting the forceps 1, 2, 3 the clean neck of the sac will be held ready for ligature, isolated from the remainder of the sac B by this incision.

due to the well-intentioned but ill-advised efforts of the surgeon to effect repair. Bearing in mind that the success of an operation lies in the simpleness thereof, I evolved the procedure described below. The majority of herniæ occurring in men of military age are amenable to cure by a small operation. The operation described below has been performed as a routine method in all cases. The advantages of this operation as a treatment in the hernia of children will be apparent. The principles borne in mind are to remove the sac at the highest possible level with the minimum disturbance of tissue. The cutting and interference with tissues has been reduced to such a degree, that very rapid convalescence follows, and the reaction associated with hernia operation is obviated. The

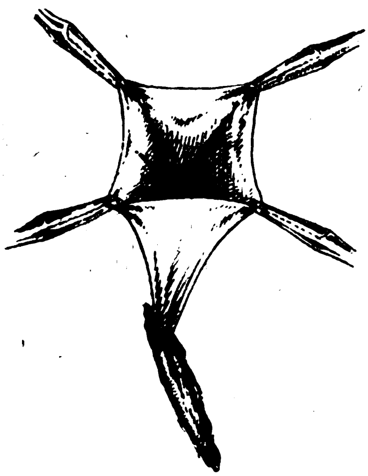


FIG. 6.—The forceps 1, 2, 3 have been raised. The neck of the sac is isolated from the remainder, which has shrunk within the coverings of the cord.

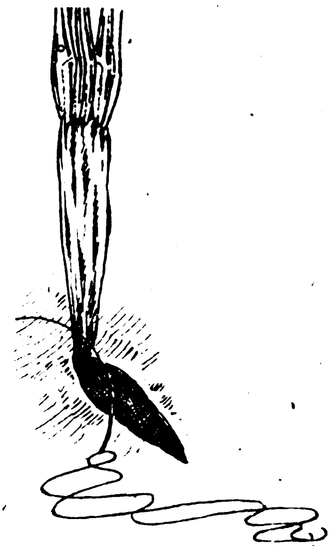


FIG. 7.—Suture of the neck of the sac.

advantages of an operation which reduces the cutting of tissues down to an inch incision in the skin and superficial fascia, and a small incision in the spermatic fascia will be apparent. No dissection of tissues is undertaken, just as Matas in his operation for aneurysm avoided injury and disturbance of surrounding structures by attacking an aneurysm from within the sac, we avoid dissecting cutting, or injuring the delicate or important structures which surround a hernial sac, by attacking the hernia from within the sac.

Without entering on the debatable ground of statistics, I am prepared to state definitely that fewer recurrences occur after this operation than after any other method of which I have experience. In hernia, as in other operations, the results depend largely on the selection of cases, and probably any experienced surgeon could operate upon a number of hernia cases by any method, with only a small percentage of failures if allowed to choose his cases.

The Operation.—We perform this operation under local anæsthesia as a

routine measure. Local anæsthesia possesses great advantages over general anæsthesia for hernia operations. A half per cent solution of novocain to which a small quantity of adrenalin is added, is used. The needle of the analgesia syringe is entered at a point midway between the anterior superior iliac spine and the spine of pubes ½ inch above Poupart's ligament. The whole anæsthesia is conducted through this puncture without withdrawing the needle. An incision from ½ inch to 1 inch in length is made over the needle puncture and carried down to the aponeurosis of the external oblique. The fibres of the external oblique are split for a distance of ½ inch. The opening in the external oblique should lie directly over the spermatic cord. The cremasteric and spermatic facial coverings of the cord are drawn through the aperture of the external oblique. The cremasteric fibres are separated, and the spermatic fascia incised, the sac is then found lying inside these coverings. Two pairs of fine hæmastatic forceps (Halstead's mosquito forceps) are placed upon the edge of the sac and an incision ½ inch in extent made between them by a snip of a pair of scissors. The two layers of the sac forming the lips of the aperture are now clipped with hæmastatic forceps. The aperture can now be held open by four pairs of forceps and four incisions are made, one between each pair of forceps enlarging the aperture sufficiently to display the interior. If omentum lies in the sac it is drawn out, ligatured, and cut off. The interior of the sac presents for examination two apertures, one, the internal ring passing into the abdomen, the other passing down the inguinal canal. These apertures are separated from one another by a process of peritoneum, the "crista," and in a well-marked case the apertures resemble the muzzle of a double-barrel shot gun. The process of peritoneum called the crista corresponds to the internal margin of the internal ring. Forceps are clipped on to the crista in one or two places. It is now necessary to separate the important tube of peritoneum leading into the abdomen (the neck of the sac) from the unimportant tube leading down the inguinal canal. This is done by cutting along the crista to the mesial side of the forceps, and dividing one layer of peritoneum with scissors. As the result of this incision, the neck of the sac now lies clear, held by the forceps on the crista on its mesial side, and the forceps on the outer side of the sac. The neck of the sac has in this way been completely exposed and freed without dissection. A gauze swab is gently passed down the outer and inner side of the sac. A gentle pull is made upon the neck of the sac whilst it is ligatured as high up as possible. It will be remembered that the crista corresponds to the internal ring and by separating the crista forming the neck of the sac in the manner described above, and pulling upon the sac, it has become possible to ligature the peritoneum, forming the neck of the sac, about two inches above the internal ring. It is unnecessary and undesirable to perform any displacing manœuvre to the neck of the sac. When the sac, is cut off distal to the ligature, the elasticity of the peritoneum will displace the ligatured sac well behind the rectus muscle. In ninety per cent of cases this is all that it is necessary to do, and the skin incision is sutured with silkworm gut passing down to, and taking up the edge of, the external oblique. In cases in which a large internal ring or very thin peritoneum renders a recurrence more possible, the conjoined tendon is drawn over the cord and sutured to Poupart's ligament without enlarging the wound. In exceptional cases it may be considered desirable for similar reasons to convert the operation into a typical Bassini

operation. This can be done with ease by enlarging the split in the external oblique for another inch or more, lifting the cord and suturing the compound tendon of the internal oblique and transversalis beneath it to Poupart's ligament. Experience has shown that when a recurrence occurs, it is usually an immediate recurrence. The recurrence occurring immediately the patient gets up is due to faulty ligature of the neck of the sac. The elastic peritoneum released after ligature of the aperture is very liable to slip the ligature. This cannot occur if the aperture formed by the neck of the sac is sewn in addition to simply tying the ligature.

The majority of herniæ occurring in men of military age are small bubonoceles or congenital herniæ containing omentum.

I attach considerable importance to the removal of the prolapsed omentum, which is always of abnormal length, with a view to preventing recurrence.

Several sequelæ follow hernia operations which are of more significance than recurrence; I refer to such conditions as hydrocele, retraction of testicle, thickening of the spermatic cord, painful scars, neuralgia and enlargement of the testicle.

These unpleasant and almost incurable results are due to damage to the spermatic cord, the delicate structures of which are adversely affected by much less disturbance than is usually supposed. In the operation described the only content of the cord which is either seen or touched is the sac.

I have found this operation of particular value when dealing with cases of recurrent hernia. The new operation is performed above the matted scar tissue of the old operation and completed by Bassini's method almost with as much ease as a primary operation.

SOME ANÆSTHETIC POINTS.

By Captain C. T. W. HIRSCH.
Royal Army Medical Corps.

In an American Journal I noticed some time ago a rather apt doggerel:—

"The very worse saying
More people betraying
Than anything under the sun,
Is, just give a whiff
Of chloroform, if
There's nothing much to be done."

It came to my mind lately when some doctors said they dreaded to have to give an anæsthetic, and that they would appreciate some tips. Hence this article.

It is said that a motorist has three speeds, viz., that which he tells the police he is driving at, the one he mentions to his friends, and that which he really drives at. So with the anæsthetist, the method the surgeon remarks on, the one the patient comments about on the following day, and lastly, that the administrator imagines he himself is employing. These three, like the automobilist's speeds, do not always coincide.

The anæsthetist is really the pilot, who has charge of the ship of life, while it is sailing in a reef-abounding sea. My methods have, up to date anyway, always enabled me to get my bark safely into port, and I trust if any trouble to peruse these hints that they will experience like fortune.

The points to safeguard the welfare of the patient are:—

(1) Proper preparation of patient, including preliminary hypodermic of morphia and atropine.

(2) Suitable selection of anæsthetic and method.

(3) A gradual induction.

(4) The maintenance of a patent airway.

(5) Uniformity of anæsthetic dose and anæsthesia.

(1) The Preparation of the Patient.

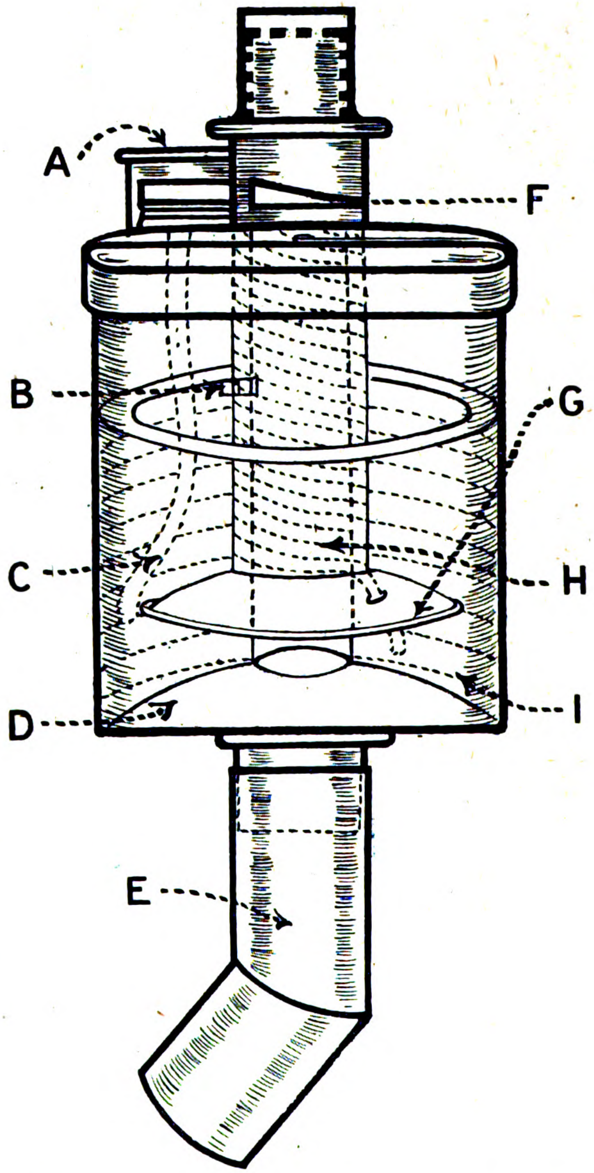
Where possible the bowels should be cleared out by medicine given on the second night before the anæsthetic, followed by an enema early on the day of operation. Only light nutritious foods should be taken for a couple of days before. Unless the patient is in a very feeble state of health the last meal should be taken not later than five or six hours before the operation. The meal should consist only of soup, freed from fat, broth or meat jelly. Milk is undesirable.

The best preliminary hypodermic is morphia one twelfth and atropine one hundredth grain, given twenty minutes before the anæsthetic starts.

(2) The Selection of Anæsthetic and Method.

In military hospitals there are, roughly, two classes of cases, young men in first-class condition in the hospitals in England, who come in for hernia, varicose veins, appendicectomy, nerve suture, or orthopædic operation; and at home, but from the fighting line, of men in a condition of shock, or of serious sepsis. The first are ideal with chloroform given with a percentage inhaler, the second are easily anæsthetized, but much more likely to suffer afterwards. Nitrous oxide and oxygen with occasional ether answers well with these cases, or warmed ether especially if oxygen is bubbled through or over the ether, and a subcutaneous saline with glucose given at the same time. The test of a suitable anæsthetic is: a quiet induction, a good colour, the relaxation the operator desires, and an absence of post-anæsthetic sickness. With some a bit of lint and a drop bottle will achieve this. I prefer the percentage chloroform inhaler; the following description is condensed from my original article in the *Lancet* of April 1, 1916:—

The apparatus, as illustration shows, consists of a metal cylinder divided by a thin-domed false bottom into two chambers. The lower one is coned to take an ordinary gas face-piece, and is provided with a movable angle connexion for use when the patient is on his side or face. Various pieces are made with different angles so that the pot can be kept fairly vertical, irrespective of the patient's position. A central tube passes through the lid and upper chamber, terminating in the false bottom, and conveys air directly to the face-piece. This central tube is surrounded by an air cone which is expanded below over the false bottom in a baffle plate, so as to distribute the air equally over the anæsthetic. A by-pass passes from the upper chamber through the cone and projects into the air tube. The air cone is provided with an opening or port, admitting air to the upper or chloroform chamber. The size of the port is regulated by a movable collar on the lid, and an indicator shows the percentage of chloroform which is passing to the face-



Explanation of Figures on Sketch.—A, Inlet for chloroform addition; B, chloroform by pass to air chamber; C, chloroform tube; D, hollow dome; E, angle connexion for face-piece; F, port or air inlet closed; G, baffle plate; H, absorbent wick for chloroform around central cone; I, Absorbent wick around walls of chamber.

piece. The upper chamber is surrounded inside with wick, and also has wick round the inner cone. Both wicks touch the bottom of the upper chamber, the latter one by passing through a hole in the baffle plate. The lid is removable, but to save taking it off during the administration of the anæsthetic, a screw-on cap in the lid permits the addition of chloroform to the upper chamber. The wicks can be removed, and the whole apparatus sterilized, after which, of course, it must be thoroughly dried before the wicks are replaced.

To use the inhaler, twelve drachms of chloroform are placed in the upper chamber, which saturates both wicks and leaves a layer on the false bottom below the baffle plate, but not touching it. Care must be taken that the chloroform does not reach as high as the baffle plate, otherwise the apparatus will not work correctly. The indicator is put to zero (port closed). An ordinary gas face-piece is attached to the coned end, either directly if the patient is on his back, or if in another position by means of one of the angle pieces. The face-piece is then adjusted to the patient's face, so that the only admission of air is by the air tube. Pure air is then breathed. As the port is opened, chloroform vapour is drawn through the by-pass in the same way as air is sucked into a Bunsen burner or a Fletcher gas stove. The expirations of the patient maintain a constant temperature in the chloroform chamber, and from actual experiments at that temperature the dial on the lid is graduated to show the percentage being inhaled. In use it is found advisable to start with the port closed, indicator at zero, and to take five to ten minutes in passing gradually to 2·5 per cent, when surgical anæsthesia is generally produced. A higher percentage is rarely needed. Anæsthesia, when obtained, can be maintained at from one to two per cent, especially if one-twelfth of morphia and a hundredth grain of atropine are given twenty minutes prior to the induction. With this preliminary narcotic and a slow induction, the struggling stage is nearly always eliminated even with robust soldiers. The only important point is to make a gas-tight joint between the face and inhaler, which can always be obtained by the use of an appropriate-sized face-piece. I recommend Barth's. Face-pieces are not included with the inhaler. I strongly recommend after induction the introduction of an airway; it ensures a free supply of air, and prevents slipping back of the tongue.

Oxygen can be given at the same time by slipping a pewter tube connected with an oxygen cylinder into the air-tube. In certain cases this has many advantages, especially if the gas is warmed.

After induction with chloroform, ether can be substituted and anæsthesia thus maintained. With the indicator at full, over ten per cent is obtained; if a higher percentage is needed, four layers of gauze can be attached to the air tube and additional ether dropped on. A special frame is provided for this purpose. By this means any depth of ether anæsthesia can be obtained.

After use the air-tube and chamber should be cleaned with sterile gauze.

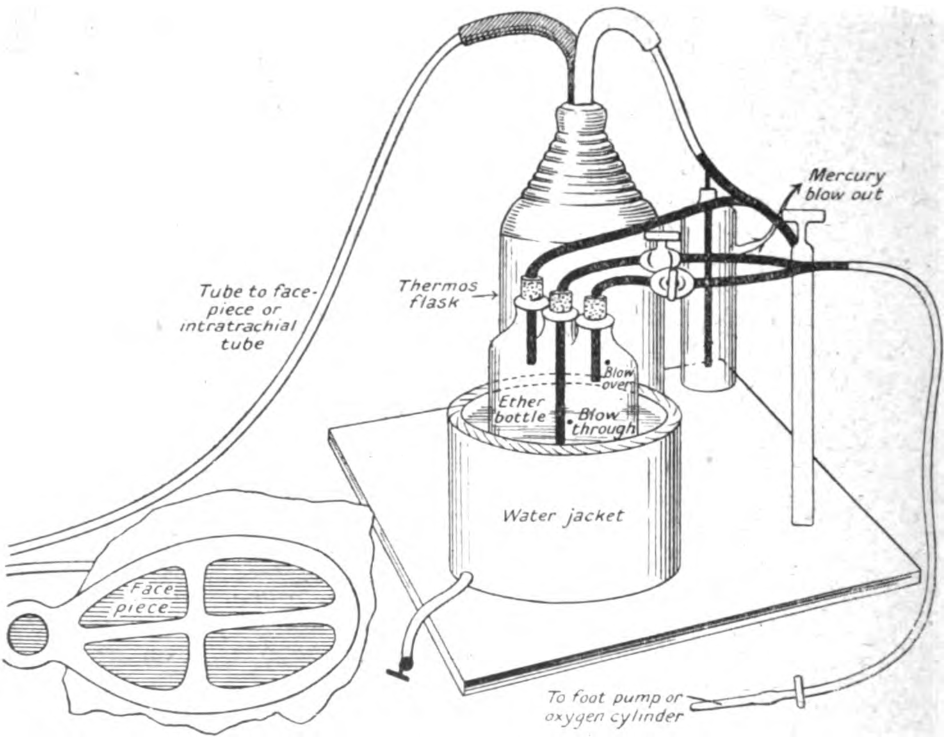
(3) A Gradual Induction.

With the percentage chloroform inhaler this is easily obtained. For warmed ether the induction can be started with the percentage inhaler, putting in only half a drachm of chloroform, and gradually adding ether, if needful, dropping ether on gauze over the airpipe, at the end of induction, and then substituting a Skinner's mask with two layers of flannel, with a copper pipe under the flannel,

to which the warmed ether can be conveyed by a rubber tube. The copper tube I use is attached inside the mask, and is punctured on its under surface, so that the warmed vapour is equally distributed under the mask. The mask fits more accurately if a piece of spongiopiline with hole for face and nose is put on the face.

(4) The Maintenance of a Patent Airway.

Most of the worries of an anæsthetist are the result of mechanical obstruction to the respiratory passage. Obstruction through mucus is eliminated by a preliminary hypodermic of atropine. Falling back of the tongue is obviated by the introduction of an airway as soon as the patient is under, and before he is brought into the theatre. I usually put in a Bellamy Gardner mouth prop before I start



A Simple Warmed Ether Apparatus.

the anæsthetic, and thus can put the airway in without using a gag when the patient is under. Care should be taken to see that the tongue is under the tube.

Colonel Silk advises the employment of a $\frac{1}{4}$-inch rubber nasal tube. I have found this useful when not employing the airway.

(5) Uniformity of Anæsthetic Dose and Anæsthesia.

When once the patient is under, the dose should be regulated so as to maintain a uniform degree of anæsthesia. For ordinary cases the corneal reflex can be fairly brisk, and, with watching, the patient can be maintained quite comfortable at one to two per cent. Where there is likely to be traction on intestines, gall

bladder, uterus, or for orthopædic wrenchings, osteotomies, etc., the patient must be fully under. In these I abolish the corneal reflex, and, if needful, push the anæsthetic to three per cent chloroform—of course watching the respiration all the time, and slacking back when all cause of shock is over. A regularity of depth of anæsthesia often means an absence of post-anæsthetic sickness. An irregular anæsthesia, one moment light, then deep, is most dangerous.

For warmed ether, I pump air through or over ether in a Wolf bottle, and then through a copper coil in a thermos flask filled with boiling water. This apparatus is illustrated and can be used for intratracheal ether. Mercury blow-out is attached.

Instead of using a foot or hand bellows, oxygen may be bubbled through or over the ether. This is most useful in cases of shock, such as orthopædic wrenchings, osteotomies, or in abdominal operations when there is traction on the intestines, gall bladder, etc.

From observation of many thousand cases, I have come to the conclusion that the velvet hand style of surgeon is the one who obviates shock more than another, and that if the operator and anæsthetist are in accord, and work together, it adds greatly to the safety of the patient.

VARICOSE ANEURYSM FOLLOWING BULLET WOUND OF ARM: EXCISION, AND END-TO-END ANASTOMOSIS OF BRACHIAL ARTERY.

By GEORGE L. PRESTON, F.R.C.S.E.
Surgeon, Military Hospital, Devonport.

Private —— was admitted to the Military Hospital, Devonport, on October 18, 1916, with a history of having been wounded five months previously. Wounds at the time healed rapidly, there was no excessive hæmorrhage; progress uneventful.

On admission: There were healed wounds of the left arm 3½ to 4 inches above the elbow joint. Entrance on inner aspect over the line of the brachial, artery; exit wound more external at outer border of biceps. There was some swelling about the size of a walnut in the line of the wound and the artery. The swelling pulsated strongly, was expansile, and a well-marked thrill and bruit were demonstrated. X-ray examination revealed nothing further, no foreign body or injury to the bone was seen. There was also some tenderness on pressure over the swelling, and continuous pain referred along the distribution of the median nerve in the index, middle and radial side of the ring finger of that hand. No anæsthesia or paralysis. Radial pulse on the affected side somewhat delayed.

A diagnosis of arterio-venous aneurysm and of varicose aneurysm in particular, with some involvement and pressure on the median nerve, was made, and operative treatment decided upon.

Operation.—Under ether anæsthesia an incision about six inches long was made over the swelling, and by careful dissection the brachial artery and median nerve were isolated above, and then traced downwards towards the sac. The nerve was first dissected free from the sac, to which it was intimately adherent by dense scar tissue, and then by working from below upwards and retracting the biceps outwards, the nerve was completely freed, and found to be intact. The next step consisted in freeing the vein and in suturing the lateral opening in it with fine catgut. The sac itself was then dealt with. On laying it freely open and removing some small clots, it was found to be bilocular—one portion being

anterior, the other posterior, to the main vessel—also that the origin of the anastomotica magna was involved in the sac. The possibility of a reconstructive endo-aneurysmorrhaphy was considered, but thought inadvisable in view of the bilocular condition of the sac. On account of the involvement of the anastomotica magna and its necessary ligation, it was decided that it would be better, if possible, to excise the whole of the sac, and to perform end-to-end anastomosis of the main vessel rather than ligature it above and below. The anastomotica magna was therefore ligatured, and the sac excised completely, and left in the wound for further use. End-to-end anastomosis of the brachial artery was then done by Dourrance's method (intima to intima), using fine but strong catgut, the elbow being flexed to a right angle in order to approximate the cut ends of the vessel without tension. The excised sac was then trimmed into a roughly quadrilateral shape, and this was used to reinforce the suture line in the form of a cuff or sleeve. On removal of the tourniquet, the junction was found to be quite satisfactory in that no leakage occurred, and the artery pulsated freely below. A transplanted pad of fat and fascia was also sutured around the nerve, in order to prevent any fresh adhesions forming in relation to it, and the deeper parts of the wound were closed by catgut sutures, and the skin by interrupted sutures of silk-worm gut. A tourniquet was left loosely in position, in case it should be necessary to control the circulation, and the elbow kept flexed to nearly a right angle by means of a bandage to prevent any tension on the sutured artery. The next day a radial pulse could be demonstrated at the wrist, but this was somewhat weak and delayed; it, however, improved very much later on. Healed *per primam;* sutures removed on the tenth day; progress uneventful. The pain was now quite absent, and the pulse was easily palpable at the wrist. Patient was discharged to duty some weeks later perfectly well.

Note.—A tourniquet was used in this case to control the bleeding during the operation; this was, however, not necessary, and I am firmly convinced that it was a mistake. It would have been preferable to have used a light clamp on the vessel itself sufficient to control the circulation through it and no more—the use of a tourniquet causing so much vaso-constriction as to make the operation doubly difficult on account of the marked diminution in the calibre of the vessel concerned.

An X-ray examination is always advisable in all cases of plastic operations as a preliminary measure to eliminate the possibility of a foreign body or a sequestrum being present with their attendant risks of latent sepsis, even when the wound has healed—and some months have elapsed since it has done so. I have seen such latent infections lighted up afresh during operative interference even after a period of between three and four months of a completely healed wound. This has, I believe, been generally recognized as a source of danger in all war wounds, such as we are dealing with to-day, and foreign bodies, such as bullets, when in situations difficult of access, are frequently left alone even when causing considerable inconvenience if the wound be healed; how much more important is it then to be able to eliminate the risks of sepsis in such operations as arterial suture, bone grafting, and tendon and nerve transplanting, where the whole success of the operation depends primarily on irreproachable technique as regards asepsis?

I am indebted to Colonel Kay, in charge Military Hospital, Devonport, for the permission to publish these notes.

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Original Communications.

THE TRENCH AND ENTERIC GROUP OF FEVERS COMPARED AND CONTRASTED.

By Major H. FAIRLEY MARRIS.
Royal Army Medical Corps.

THE toxins of trench fever stimulate, those of the enterica depress the nervous system: with such recognition they may be readily differentiated by clinical means.

During the present campaign on the Western Front the difficulties both bacteriological and clinical which confront one in the diagnosis of certain febrile conditions are now widely recognized. From the evidence to be brought forward in this paper it would appear that the greatest confusion exists between the "Trench" and "Enteric" group of fevers. From a superficial examination the reasons for such confusion are fairly obvious, as the pyrexial periods often resemble one another closely and the occurrence of a rash and an enlarged spleen are frequently observed in both groups of fevers. Closer investigation, however, shows real and substantial differences, and a careful study of the clinical signs in the abdominal, cardio-vascular and nervous systems has brought out certain striking points of variance between these two groups of fevers which possibly help to throw some light upon their pathology.

The following account of a group of fevers which from their common symptomatology and types of pyrexia may be styled "trench fever" is the result of an analysis of 200 cases admitted as enteric "suspects" to a hospital specially equipped for the reception of such cases. An exhaustive bacteriological, serological and clinical examination has been carried out upon each case, together with similar observations upon 100 cases of the enteric group from which the infecting organism has been isolated.

The Symptomatology of Trench Fever.

In the trench fever group under consideration three main types are here recognized and these are based upon a more or less characteristic period of pyrexia.

The symptoms are practically identical in the three types, namely, sudden onset with severe headache with pain behind or on moving the eyes, dizziness, backache and pains in the limbs—usually the lower—generally aggravated at night time. The patients are usually constipated although a little diarrhœa and vomiting may occur, and with the subsidence of the fever the symptoms rapidly disappear, only to return with any relapse, and during convalescence tachycardia frequently supervenes.

The three types of fever are briefly described as follows:—

Type "*A.*"—A pyrexia of 102° to 104° F. lasting from six to twelve days, a remission to 99° or thereabouts for one day, frequently being observed about the third or fourth day; at the termination of the fever convalescence is usually established, although a mild relapse of one or two days' duration is occasionally seen. During convalescence tachycardia of short duration sometimes occurs. Among the seventy-two cases conforming to this type, twelve per cent had tachycardia.

Type "*B.*"—With an initial fever of 102° to 105° F., lasting from two to four days, followed by relapses varying from two to eight in number, the duration of the relapses being from one to three days, the periodicity from three to six days; the rise in temperature is generally less with each successive relapse and these may even be afebrile. The symptoms generally are in abeyance between the relapses: prolonged tachycardia is frequently observed to occur during convalescence. Among the ninety-three cases conforming to this type, thirty-seven per cent had tachycardia.

(The above two types correspond in the main to "A" and "B" types described by McNee, Renshaw, and Brunt.[1])

Type "*C.*"—The "enteric" type with prolonged "spiky" pyrexia of 100° to 103° F., lasting from fourteen to thirty days or even longer with recurrences of like duration. Intractable tachycardia very frequently arises during convalescence. Among thirty-five cases conforming to this type, fifty-seven per cent had tachycardia.

The Symptomatology of the Enteric Group.

The disease "enteric," using the term to denote infections by *Bacillus typhosus*, *B. paratyphosus* A, and *B. paratyphosus* B, differs conspicuously by its mildness from enteric as it occurred in the early days of the war and as it occurs in civilian practice. To-day the onset is at times sudden, with headache, giddiness and shivers; uneasy feelings in the abdomen, and occasionally pains in the limbs; and the occurrence of tachycardia

[1] "Trench Fever." By McNee, Renshaw and Brunt, *British Medical Journal*, February 12, 1916.

during convalescence; a clinical picture superficially resembling the trench fever group.

In the subjoined table the symptoms of 200 cases of trench fever, which were bacteriologically and serologically declared free from an enteric infection, are shown as compared with the symptoms in the last 100 cases of the enteric group in which the causative organism has been isolated from the blood, stools, or urine, and which have been under my care during the period of time (eighteen months) in which these cases of trench fever were admitted as enteric suspects.

"*Trench Fever.*"		"*Enteric Fever.*"	
Type A	27 cases	Typhoid	24 cases
Type B	93 ,,	Paratyphoid A	67 ,,
Type C	35 ,,	B	9 ,,
	200		100

	History usually very Definite		*History generally Indefinite*	
Onset gradual	24		40 per cent	
,, sudden	76 per cent		60 ,,	
Headache	96 ,,	sharp lacinating	91 ,,	dull, generalized
Pains behind or on moving eyes	42 ,,		10 ,,	
Photophobia	10 ,,		2 ,,	
Dizziness	68 ,,		35 ,,	
Shivers	35 ,,		18 ,,	
Diarrhœa	10 ,,	(slight, 1 to 3 days)	21 ,,	(more prolonged, 7 to 18 days)
Constipation	75 ,,		25 ,,	
Vomiting	18 ,,		12 ,,	
Abdominal pain or "uneasiness"	15 ,,		73 ,,	
Limb pains	95 ,,		24 ,,	
Backache	62 ,,		8 ,,	
Sweating	15 ,,		12 ,,	
Epistaxis	3 ,,		9 ,,	
"Sore throat"	6 ,,		10 ,,	
Cough expectoration (bronchitis), etc.	7 ,,		16 ,,	

An analysis of the above table shows in the *Trench Fever Group* the history to be definite; the headache severe and localized; dizziness and shivers frequent; constipation usual; limb pains and backache nearly always present.

On the other hand, in the *Enteric Group* the history is usually indefinite; the headache constant, dull, and not definitely localized; abdominal pain or uneasiness fairly constant; diarrhœa and cough with expectoration are more frequently seen; limb pains and backache are often noted.

Before contrasting the clinical *signs* generally in the two groups of fevers, the special investigations and findings in the abdominal, cardio-vascular and nervous systems will be briefly described.

THE ABDOMINAL SYSTEM.

For the sake of convenience the tongue will be considered here. In the trench fever group the tongue is usually entirely covered with cream-coloured fur, although it may be practically clean throughout the course of the fever. When furred it generally becomes clean remarkably quickly (two to seven days). In the enteric fevers the tongue is almost universally characterized by fur light brown in colour, and remains furred for a long period of time (two to four weeks).

The *spots* in trench fever appear fairly early (second or third day) upon chest or abdomen, suddenly and in crops. They are fairly uniform in size, from four to eight millimetres in diameter with fairly well-defined edges, varying in hue from bright pink at first, turning later to a dull rose colour. They disappear on pressure; they are *not* raised, although vesiculation has been observed in a very few cases. They last from six to forty-eight hours, and disappear suddenly leaving no stain; at times they make their initial appearance during the relapses, which may be afebrile; occasionally the areas in which they occur suggest distribution.

In the *enteric fevers*, the spots appear later at the end of the first week of the disease, generally upon the abdomen. They vary greatly in size (two to twelve millimetres), being large, with ill-defined edges. In the paratyphoid fevers the colour is more subdued, they disappear on pressure, *are raised*, last longer, and fade slowly, frequently leaving a stain; vesiculation is not seen; the area in which they appear is widely scattered, suggesting no particular anatomical distribution.

The Spleen.—In cases of *trench fever* the spleen is frequently palpable, firm, with well-defined edge, and is generally felt early in the disease, second or third day; it is often observed to increase suddenly with the relapses and decrease or disappear during the afebrile periods; occasionally the enlargement may not be apparent until the second or third relapse.

In cases of *enteric fever*, splenic enlargement is rarely observed before the end of the first week. The spleen is not firm but spongy, and there is no well-defined edge. When palpable, it remains so for considerable periods of time. It increases and decreases gradually in size.

The abdomen generally in the trench fever group is usually firm, whereas in the enteric group it may be described as doughy, tumid and at times tympanitic.

Abdominal pain and tenderness will be discussed under the nervous system.

THE CARDIO-VASCULAR SYSTEM.

In the examination of the cardio-vascular system four-hourly charts were used both during the febrile and afebrile periods of trench and enteric fevers, and thus frequent records of the temperature and pulse rates were ensured. The pulse rate during sleep was often recorded. The apex beat of the heart was observed and localized throughout the disease. The cardio-ocular

reflex was studied. The effect of atropinization upon the pulse rate was determined.[1] Frequent observations were made upon the systolic blood-pressure, the auscultatory method being used; and the effect of intravenous injections of adrenalin upon the heart rate and blood-pressure were noted.

In cases of the *trench fever* group. When the temperature, pulse, and blood-pressure curves (such records being always made simultaneously) are studied together, they are usually observed to follow one another closely. In convalescence, however, in about twenty-seven per cent of the cases the pulse and pressure curves are seen to rise unduly for a variable period of time—two to seven weeks—yet during sleep at this time the pulse rate is nearly always observed to be normal.

A study of daily charts of cases styled type B would suggest the rapid changes in temperature as observed in cases of malaria. However, the four-hourly charts in these cases (vide Chart X) show that although the rise in temperature and pulse rate was rapid the fall was much more gradual, and rigors and sweating were not common features.

The cardio-ocular reflex[2] was generally normal, that is to say, the pulse rate usually fell some ten to twenty beats. The response of the heart rate to atropine was nearly always that observed in health, namely, the rate was accelerated by some fifteen or more beats a minute. The apex beat of the heart when present did not disappear for a time during the disease. In a few cases it became displaced outwards, dilatation of the heart being observed in eight per cent of the cases. Intravenous injections of adrenalin[3] produced the effect witnessed in healthy folk, namely great acceleration of the heart rate with a considerable rise in blood-pressure.

In cases of the *enteric group*, similar observations showed the following points. During the early stages of the malady the pulse and pressure curves were seen to fall rapidly while the temperature curve still remained high. The pressure curve was observed to be depressed for a considerable time before the normal was regained. During convalescence in ten per cent of the cases the pulse and pressure curves were seen to rise unduly for a variable length of time. Nevertheless during sleep at this period the pulse rate was generally observed to be normal. The apex beat of the heart was frequently observed to disappear and later in the disease to reappear. Evidence of dilatation of the heart was present in sixteen per cent of the cases.

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[1] Medical Research Committee. "A Report upon the use of Atropine as a Diagnostic Agent in Typhoid Infection." No. 9.

[2] Atropinization produced the effect almost invariably seen in enteric infections during the second week of the disease; namely the heart rate was not accelerated as it is in health and as it is in cases of trench fever.

[3] Medical Research Committee. "A Report upon the use of Atropine as a Diagnostic Agent in Typhoid Infections." No. 9.

Intravenous injections of adrenalin produced the characteristic rise in pulse rate, but *failed* to raise the blood-pressure to that degree observed in health and in cases of trench fever.

The Nervous System.

In addition to the ordinary examination of the central nervous system, special attention was directed towards the sensory system, and also to the pilomotor and vasomotor reflexes. In the sensory system the presence of hyperalgesia was sought for, superficial and deep cutaneous, as well as muscular. It may not be out of place to describe briefly the method and the phenomena as far as they have been observed.

Examination for the presence of cutaneous hyperalgesia should be conducted speedily, as when present in this disease it is not usually so well marked as in cases of neuritis, etc. Prolonged exposure of the patient to cold air produces numbness, and so renders the recognition of hyperalgesia more difficult.

Muscular hyperalgesia may be ascertained by grasping such muscles as the pectorals, latissimus dorsi, erector spinæ, etc., between thumb and fingers and comparing their sensibility with the corresponding muscles of the opposite side of the body. Some difficulty is experienced in determining muscular hyperalgesia when cutaneous hyperalgesia is present in the overlying skin.

The Vasomotor and Pilomotor Reflexes.—These reflexes may be studied at one and the same time by drawing the finger pad briskly and firmly down the front of the chest. In health the part pressed upon is seen to blanch and the subject may speedily feel a chilly sensation referred to the upper chest and at times the inner side of the arm. This constitutes the *sensory vaso-constrictor reflex*, and is coincident in time with the appearance of "goose" skin, at first upon the part pressed and then rapidly spreading over the upper zone of the chest and maybe down the arm; thus exhibiting a local and general reflex. At the same time the pupil on the same side may be seen to dilate.

(This description is roughly taken from "Symptoms and their Interpretation," by Sir James Mackenzie.)

The *general* reaction is then observed to fade away quickly, followed by the disappearance of the *local* reaction, some twenty seconds being occupied in this part of the phenomena.

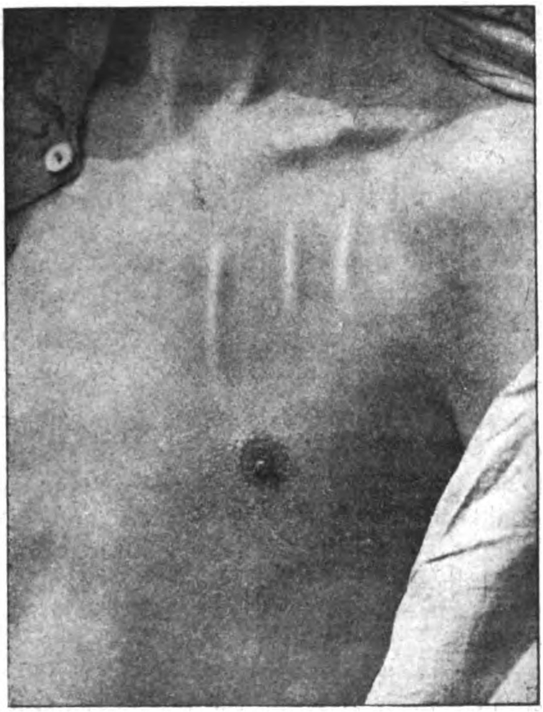
The finger track is now seen to redden (the vaso-dilator effect) and remains so for three to fifteen minutes before subsiding.

Examination for the presence of myoidema and miotatic irritability was made.

In cases of *trench fever* examination of the nervous system brought out the following points. The mental condition remains acute throughout the disease, the ordinary reflexes throughout the body are exaggerated; a pseudo-ankle clonus is common; the plantar reflex is flexor in type;

a fine nystagmus is often noted, especially when the cases are examined during the early stage of the disease. In addition, bilateral cutaneous hyperalgesia with root distribution is found in the thoracic and lumbar, rarely in the cervical or sacral segments. The characteristic feature of the sensory disturbance is the complete absence of any objective sign save that of an enlarged spleen, which accounts for the only viscero-sensory reflex observed, this being present in the left iliac fossa.

The *pilomotor reflex* is grossly exaggerated, the goose skin being more pronounced.



To illustrate the excessive muscular irritability (myoidema) often observed in cases of trench fever. The middle wave is stationary and is produced by the direct action of the finger pad drawn firmly down the pectoral region ; the two lateral waves are moving, the one travelling outward, the other inward, each starting from the primary stationary wave.

The *vasomotor reflex* appears quickly, is of bright red hue lasting a comparatively short period of time ; the viscero-sensory reflex, i.e., the "chilly" sensation, is occasionally noted by the patient. Frequency of micturition with no abnormality in the quality or quantity of urine was occasionally noted, suggesting hypersensitiveness of the bladder ; muscular tone is preserved, wasting is rarely seen.

Myoidema and miotatic irritability are usually very marked. In connexion with this phenomenon as displayed by firm pressing of the fingers down

the front of the chest over the pectoral muscles, I have lately found that many of the cases show in addition to the myoidema or heaping up of underlying muscle fibres, two waves of muscular contraction, one on either side of the fixed myoidema; the outermost is seen to travel somewhat slowly towards the insertion, the innermost towards the origin of the pectoral muscle, some one and a half to two seconds being occupied by the process. This phenomenon is usually seen when the fever is high, although occasionally it may persist for a considerable period of the disease.

Examination of the Nervous System in Enteric.

When the nervous system is examined in a similar manner in the enterica, a distinct contrast is seen, the mental condition being blurred, the general reflexes throughout the body depressed and often absent. Cutaneous hyperalgesia is a rare characteristic, but when present is invariably accompanied by some associated objective sign, such as pleurisy, pneumonia, an enlarged spleen, thrombosis, or a perforation, this constituting a viscero-sensory reflex. The pilomotor and vasomotor reflexes are often observed to undergo the following changes :—

Pilomotor Reflex.—About the end of the first week of the disease, the general reaction vanishes, and in a day or so the local reaction also disappears. Later in the disease, towards the end of the second or third week, the local reaction is observed to reappear, and subsequently the general reaction becomes re-established.

Vasomotor Reflex.—Coincident with the above phenomena, the subsequent reddening of the skin appears slowly, is dusky purple in colour, and remains so for very long periods of time; in addition, the sensory reflex, namely, the chilly sensation, is not experienced by the patient.

Retention and incontinence of urine are occasionally noted, suggesting a depression of the nervous mechanism of the control of the bladder. Muscular tone is speedily depressed, and considerable wasting of the muscles is usually observed. Myoidema and miotatic irritability are generally in abeyance.

Limb Pains.[1]—In cases of trench fever limb pains are often associated with the presence of hyperalgesia with a root distribution. In cases of enteric with limb pains no hyperalgesia is observed.

Abdominal Pain.—In cases of trench fever with abdominal pain intestinal disturbance is rare, but a belt of cutaneous hyperalgesia extending from the sixth or eighth to the tenth or twelfth dorsal segments is often identified. Deep tenderness is rare.

In cases of enteric, intestinal disturbance is the rule, and only very occasional cutaneous hyperalgesia noted, and that is present in the left

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[1] Limb pains are common in febrile complaints occurring in the armies. In fifty-eight cases of jaundice of infective origin reported by Dawson and Hume (Q.J.M., 37 to 38, October, 1917), this was noted in over sixty per cent of the cases. I have observed nine cases of this disease with limb pains. In no instance was any cutaneous hyperalgesia noted.

iliac fossa and is associated with an enlarged spleen. Deep tenderness is common.

TABLE SHOWING THE PHYSICAL SIGNS IN 200 CASES OF TRENCH FEVER CONTRASTED WITH THE SAME SIGNS IN 100 CASES OF THE ENTERIC GROUP IN WHICH THE ORGANISM WAS ISOLATED.

	Trench Fever		Enteric Fever	
General Appearance :—				
Flushed	75 per cent		25 per cent	
Herpes	9 ,,		1 ,,	
Conjunctivitis	27 ,,		3 ,,	
Tongue furred	70 ,,		94 ,,	
Cleaning rapidly	65 ,,		8 ,,	
,, slowly	20 ,,		89 ,,	
Abdomen distended	6 ,,		27 ,,	
,, tender	15 ,,	(usually superficial)	77 ,,	(usually deep)
Spots	39 ,,		34 ,,	
Spleen palpable	40 ,,		38 ,,	
Thorax :—				
Apex beat defined throughout the disease	80 ,,		22 ,,	
Observed to disappear for a while	10 ,,		58 ,,	
Heart :—				
Sounds forcible	76 ,,		8 ,,	
,, soft	8 ,,		86 ,,	
Dilatation of heart	8 ,,		18 ,,	
Dicrotic pulse	4 ,,		47 ,,	
Bronchitis	9 ,,		63 ,,	
Blood-pressure	95 to 150 mm. Hg		75 to 120 mm. Hg	
,, ,, pulse, and temperature curves co-ordinated	80 per cent		9 per cent	
Relatively slow pulse with low blood-pressure curve	10 ,,		75 ,,	
Tachycardia	32 ,,		16 ,,	
Nervous System :—				
Mentally clear	90 ,,		10 ,,	
,, blurred	10 ,,		73 ,,	
Reflexes normal or exaggerated	85 ,,		15 ,,	
,, depressed	8 ,,		70 ,,	
Pilomotor Reflex :—				
Normal or exaggerated	88 ,,		23 ,,	
Absent or observed to disappear wholly or in part	12 ,,		68 ,,	
Vasomotor reflex, short duration, bright in colour	72 ,,		25 ,,	
,, ,, long duration, dull in colour	10 ,,		68 ,,	
Dilated pupils	75 ,,		22 ,,	
Nystagmus	18 ,,		2 ,,	
Hyperalgesia, cutaneous, muscular, or both with no objective sign save enlarged spleen	75 ,,		15 ,,	
Bladder symptom, frequent micturition	7 ,,		8 ,,	retention or incontinence
Adrenalin reaction normal	100 ,,	(20 cases)	6·6 ,,	(15 cases)
Atropine reaction normal	92 ,,		6 ,,	

The response is 15 or more per minute.

(A positive enteric atropine reaction was observed in eighteen of these cases; a possible explanation is that the stimulation of the nervous system is so extreme that the dose of atropine, namely, $\frac{1}{33}$ grain, is insufficient to remove vagal tone when excessive.)

The final bacteriological and serological report on all these cases was negative to an enteric group infection ; it would be reasonable to suppose that a few might be cases of "missed" enteric or double infections.

Examination of the lower limb elicited the following points in cases with shin pains. Cutaneous hyperæsthesia with root destruction was common, in some the whole lumbar group of muscle was hyperalgesic, in others the tibial muscles appeared to give rise to pain. Pain in the gastrocnemii was less frequently noticed. The fact that these pains are almost invariably bilateral and that no objective sign is present is a strong argument in favour of the suggestion that the focus of origin lies within the central nervous system.

On analysis the above table brings out the following points :—

In Trench Fever.—The patients are usually flushed, the tongue lightly furred, clearing quickly, the spots are evanescent not raised ; the spleen firm and often palpable, frequently increasing and decreasing in size ; the apex beat of the heart is well marked throughout the disease ; the heart sounds forcible. The temperature, pulse and blood-pressure curves are frequently co-ordinated. The blood-pressure curve is erratic, bronchial catarrh is rarely observed.

In the examination of the nervous system the mind is clear ; all reflexes are exaggerated ; nystagmus is often seen. Cutaneous hyperalgesia without objective signs but with a segmental distribution is common ; an irritable bladder producing frequent micturition is not uncommon. Herpes is seen ; the reaction of the cardio-vascular system to atropin and adrenalin is normal ; the cardio-ocular reflex is normal.

In Enteric Fever.—Pallor is more frequent ; the tongue remains furred for a considerable period of time ; the spots are usually raised and persist, leaving a stain. The spleen is enlarged and soft, remaining so for a lengthy period. The apex beat of the heart frequently disappears, the sounds are soft ; the relatively slow and often dicrotic pulse, also a very characteristic steady curve of lowered blood-pressure, is frequently observed. Catarrh of the lungs is common.

In examination of the nervous system, the mental state is often blurred ; all reflexes are diminished or often absent. Nystagmus very rare. Hyperalgesia is only observed when an objective sign is present. Herpes rare. Retention or incontinence of urine common. The response of the cardio-vascular system to atropine and adrenaline is abnormal. The cardiocular reflex is abnormal.

The vast majority of both the trench and enteric fever cases mentioned in this paper occurred in men who had been inoculated against the enterica.

As is now widely recognized the difficulties of excluding an enteric infection have been increased considerably by the triple inoculation. The bacillus is recovered in some fifteen per cent of cases only, the remainder being diagnosed by the serological tests.

The question naturally arises, Are not these cases of trench fever in reality cases of enteric, in which both bacteriological and serological examinations have failed to establish a diagnosis?

The above series of 200 cases of trench fever are extracted from some 450 consecutive cases of enteric "suspects" which were subjected to a thorough bacteriological and serological examination with negative results. Among the 200 cases of trench fever thus quoted there occurred twelve cases in men who had *never* been inoculated against the enteric group of fevers, and in each of whom the most exhaustive bacteriological examination of blood, stools and urine failed to identify any organism of the enteric group. In addition four or more serological tests performed at the critical period of the disease failed to show the *presence of any agglutinin* to any member of the enteric group, although in each case agglutinins to each member of the group were shown to be *present* in the blood *after* inoculation with the T.A.B. vaccine at the termination of the malady. Of these cases six are included in Type A, three in Type B, and the remainder in Type C of my series.

The evidence is strong against all these cases being missed cases of enteric infection. The clinical entity should thus be reasonably established. Among the remaining 250 cases of suspects which were probably not enteric, many appeared to belong to the trench fever group. The clinical findings were such as I have shown, but as the types of pyrexia were so varied and had only slight resemblance to the types described, they were not included.

General Remarks.

From the foregoing observations upon these two groups of fevers it would appear that the toxins of each group have a selective and clearly defined action upon the body. The presence of either toxin may be identified by a thorough examination of the cardio-vascular and nervous systems.

In Trench Fever.—There is evidence of irritation or stimulation. Thus the sensorium remains clear, the reflexes are exaggerated, there is no loss of muscle tone, wasting is not seen, muscular and cutaneous hyperalgesia, frequently showing a segmental distribution with occasional evidence of peripheral changes, are noted.

In examining the autonomic system, no evidence of a diminution of vagal tone is observed, a reasonable finding to which a normal cardio-vascular response and a normal response to atropine lend support. In the sympathetic system stimulation is witnessed as shown by the vivid tache, the exaggerated pilomotor reflex, the high and erratic blood-pressure.

In Typhoid Fever.—There is distinct evidence of depression of the nervous system. Thus the sensorium is dulled, the reflexes are depressed or often absent, muscular tone is speedily lost, and muscular wasting is common. Cutaneous hyperalgesia is only observed as a viscero-sensory

reflex. In the autonomic system vagal tone is practically always depressed and often abolished, this being shown by absence of cardio-ocular response and the failure of the drug atropine to accelerate the heart-rate. The frequent diminution or absence of the pilomotor reflex, the lowered blood-pressure and the failure of adrenalin to produce a rise in blood-pressure, although the heart-rate is still capable of a full response, demonstrate a marked depression.

Recently through the courtesy of Major Strong, U.S.A., I have had the privilege of examining several cases of trench fever produced by blood and louse transmission. In these cases similar pyrexias, rashes, enlarged spleens, conjunctivitis, nystagmus, erratic blood-pressure, areas of hyperæsthesia were noted. In addition the symptoms were those frequently seen in the natural disease. The response to atropin was negative to an enteric group infection in every case examined both before and during the disease.

Treatment.—A host of drugs by mouth and intravenously have been employed in these cases of trench fever with the object of arresting the fever in the prolonged cases or relieving the limb pains which at times appear to be severe. So far results have been disappointing. There is considerable evidence that the toxins of trench fever irritate or stimulate, while those of the enteric group and the enteric vaccines themselves produce a depression of the nervous system. With this antagonism in view, the effects of ½-cubic-centimetre doses of T.A.B. vaccine given hypodermically have been watched in cases of trench fever with prolonged fever or persistent severe shin pains.

In five cases of the former group in which the vaccine was given after six weeks fever, a normal temperature was observed to follow and to be maintained within forty-eight hours of the injection in two of the cases, the remaining ones showing no change. In six cases of the latter group thus treated there was no further complaint of pain in four of the cases, the two remaining being unaffected. Whether this is a case of post hoc or propter hoc it is hard to say.

On pp. 177 and 178 are shown charts and diagrams which serve to illustrate the types of trench fever described; in addition there will be found two examples of enteric cases sometimes seen to-day with pyrexial periods not unlike those of trench fever types "A" and "B." An example of what must be a double infection is also shown which may illustrate the manifold difficulties which confront the clinician in unravelling the mysteries of "P.U.O."

A Note upon Tachycardia occurring in the Trench and Enteric Groups of Fevers.

The methods adopted in the investigation of tachycardia occurring in fevers were fully described in the *Lancet* of May 11, 1918. In the article referred to I showed how ordinary bedside observation on the waking and

sleeping pulse,'[1] on the effect of posture on the heart rate and on the presence or absence of signs of heart failure enabled one to recognize and group cases of tachycardia without any difficulty into (*a*) those depending on cardiac lesions; (*b*) those secondary to an unstable vasomotor mechanism. As a result of such investigation upon all cases in the above series showing rapid heart action it was found that the tachycardias could be summarized as follows:—

Enteric (bacillus isolated).							Trench Fever (bacteriologically and serologically negative to enteric)						
		Tachycardia							Tachycardia				
	Number of cases	Cardiac	Vaso-motor	Postural	Total	Per cent		Number of cases	Cardiac	Vaso-motor	Postural	Total	Per cent
Typhoid	24	2	3	2 =	7 =	7	Type A	72	0	6	3 =	9 =	12
Para A	9	0	1	0 =	1 =	1	Type B	93	1	28	6 =	35 =	37
Para B	67	2	4	2 =	8 =	8	Type C	35	2	14	4 =	20 =	57
	100	4	8	4 =	16 =	16		200	3	48	13 =	64 =	32

From this summary it is seen that trench fever as a cause of tachycardia, and consequently a more prolonged convalescence, is much more potent than the enteric group; although the enteric group accounts for a larger proportion of the "cardiac tachycardias." The trench fevers are far more potent agents in giving rise to vasomotor tachycardia, that is to potential D.A.H.

With a view to controlling the incidence of the cases of tachycardia judged to be not of cardiac origin, namely, the postural and vasomotor varieties, the following control observations have been carried out in some 200 cases showing this disability.

Some have been detained in bed until the condition has passed off. Others have been allowed up within seventy-six hours of the temperature regaining the normal. A further series have been allowed up when the temperature has been normal for a period of eight clear days.

As a result of this inquiry, it was obvious that in the last series the incidence of tachycardia has been materially reduced; especially so is this in

[1] *Sleeping Pulse.*—As a means of determining whether a case of tachycardia is or is not of serious moment this would appear to be a valuable sign, not only as it occurs in medical but also in surgical conditions. I have examined several cases of tachycardia occurring after a variety of surgical ailments and the same deduction appears to hold good, and there is evidence to show that when observed in such cases at times convalescence might be expedited and possibly a few disasters avoided by the adoption of this observation as a routine in cases showing rapid heart action.

Sisters speedily became expert at recording the sleeping pulse from the radial, temporal, posterior auricular or facial arteries, or by ocular observation of the carotid impulse in the neck.

the postural variety; in addition the incidence and duration of the vasomotor group of cases has been curtailed, and when present they have been less resistant to treatment than when they were allowed up either too soon or too late.

The chart on p. 177 is of some interest as showing the onset and offset of vasomotor tachycardia in a case of trench fever, detained in bed throughout the malady.

Trench Fever, Type "A."

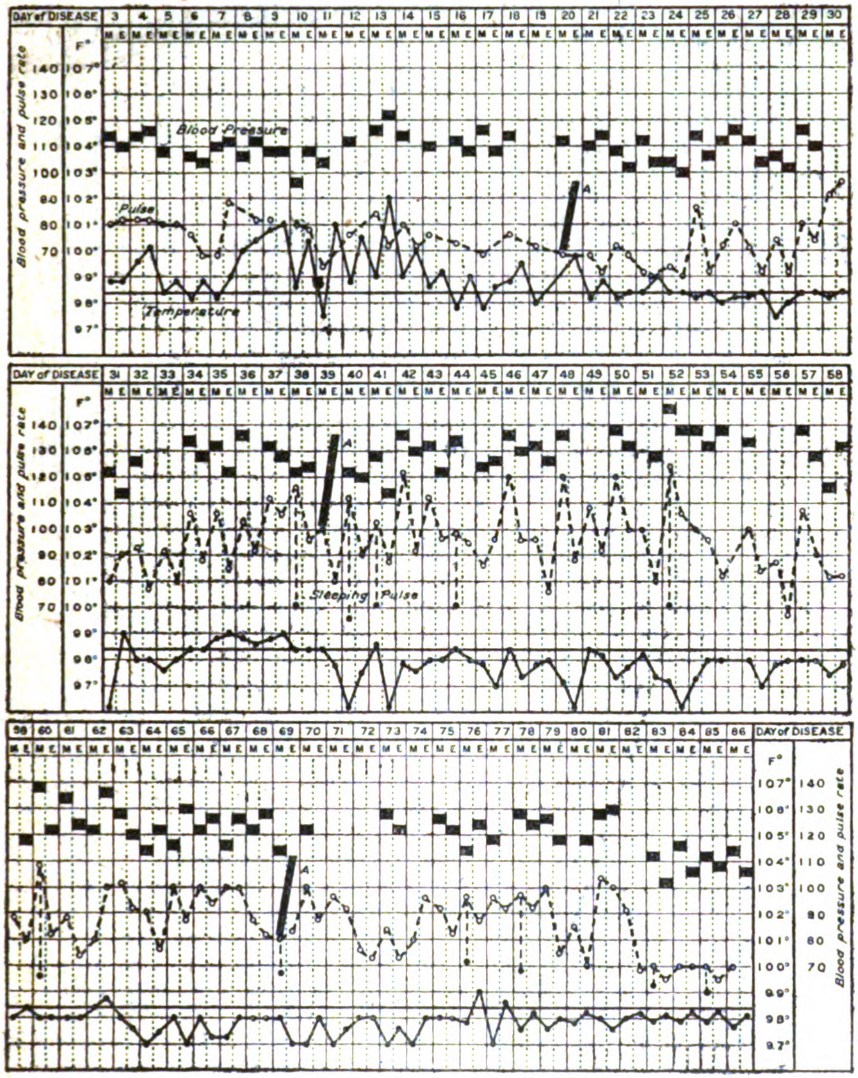
An uninoculated man, aged 25, bacteriologically and serologically free from past or present infection by any member of the enteric group of fevers.

Onset sudden with severe headache, giddiness, and vomiting; pains at the back of the eyes, and later pains in the small of the back and in the thighs and legs, the latter being aggravated at night time.

He was mentally alert throughout the illness; he was flushed, with widely dilated pupils; lateral nystagmus was present; the tongue was thickly coated with grey-coloured fur. The heart was normal in size, the sounds were clear and forcible, and the apex beat was clearly defined throughout the disease. The lungs were normal throughout. There was a fleeting bright pink rash on the fifth day of the illness, distributed over the lower half of the right thorax and the upper half of the abdomen. There was well-defined cutaneous hyperæsthesia corresponding to the sixth, seventh, and ninth dorsal, and the second, third, and fourth lumbar segments; the splenic area was hyperæsthetic. There was tenderness on pressure over the lumbar vertebræ. The lumbar muscles were tender. All the reflexes were exaggerated. The spleen was palpable from the fifth to the ninth day. The temperature was normal by the twelfth day when all the symptoms and signs had disappeared. Convalescence was uninterrupted.

The response of the heart to $\frac{1}{33}$ grain of atropine was normal on four occasions between the sixth and sixteenth days. Upon the eighth day the cardio-ocular reflex was normal, the heart rate some sixteen beats per minute. An intravenous injection of 0·25 millimètre of 1/1000 adrenalin showed a normal reaction, namely, the heart was accelerated by some thirty beats a minute. The systolic blood-pressure rose from 120 to 147 mm. Hg.

Comment.—The man was uninoculated; there was no evidence of an enteric infection. The temperature, pulse and blood-pressure curves are seen to move together. There was evidence of a toxic disturbance of the sensory nervous system. A normal response to atropine and adrenalin was witnessed in the cardio-vascular system. Three weeks later when quite fit he was inoculated with T.A.B. vaccine, and his blood was shown later to



Signs and Symptoms: Conjunctivitis; nystagmus; spots + + +; spleen +, D6; hyperæsthesia, L4; pilomoto + +; reflexes + + +; tremor; shin pains.

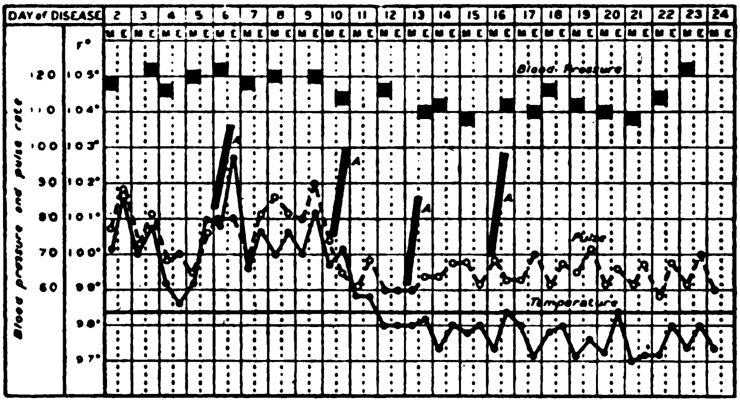
= Effect of atropine $\frac{1}{33}$ grain upon heart rate.

An *uninoculated* man, aged 21, bacteriologically and serologically negative to enteric group; clinically a case of trench fever, Type C. Note the onset of tachycardia (D.A.H.)? Note the effect of tachycardia (D.A.H.)?

November and December, 1917. "Sympathetic tachycardia" independent of posture. Belt no effect; exaggerated symptoms. In bed throughout. *Heart: Normal* in size, *sd. rhythm. Lungs, normal.*

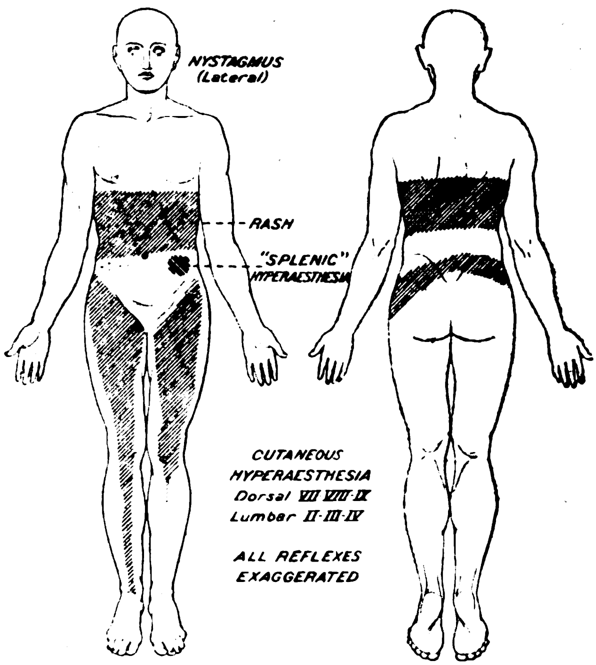
possess agglutinins to each member of the enteric group of organisms. Clinically the case presented the features commonly found in what has been described as trench fever.

TRENCH FEVER, TYPE "A."



A = Acceleration in pulse rate after $\frac{1}{75}$ grain atropine.

TRENCH FEVER, TYPE "A." THIRD DAY.

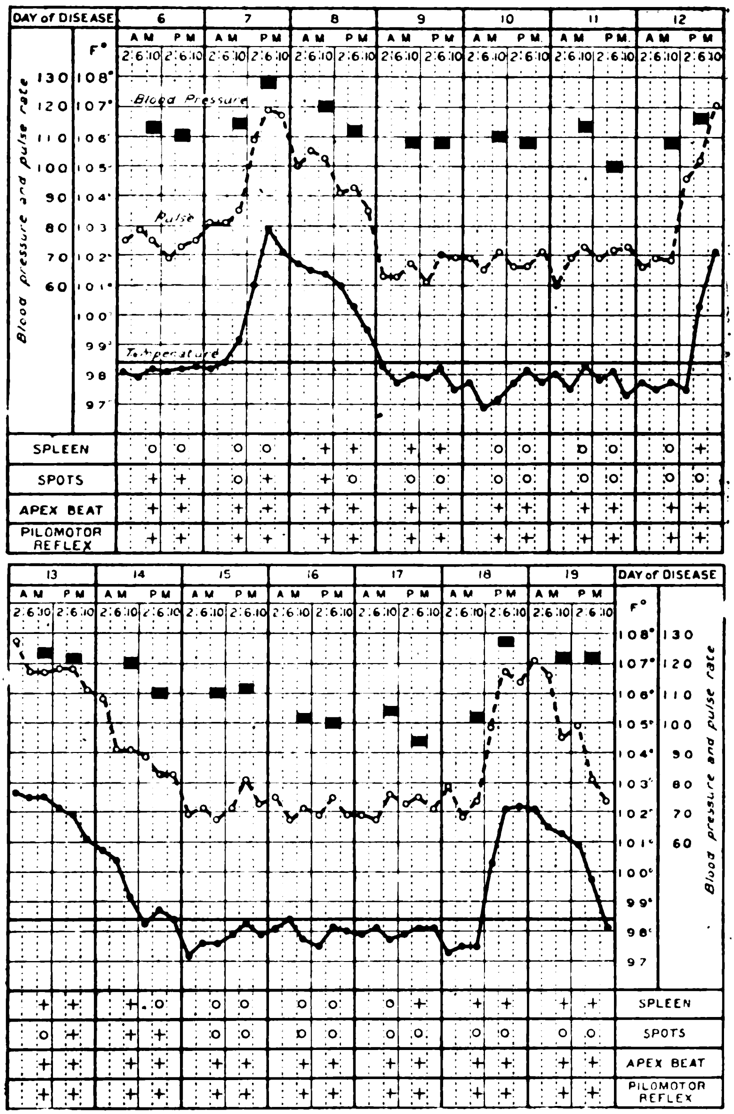


Trench Fever, Type "B."

An uninoculated man, aged 27; bacteriologically and serologically free from present or past infection by a member of the enteric group. Onset

with sudden severe frontal headache, dizziness, abdominal pain, pain on moving the eyes, and severe pains in the shins and calves at night, the latter recurring with the subsequent relapses.

CHART X.—TRENCH FEVER, TYPE "B."



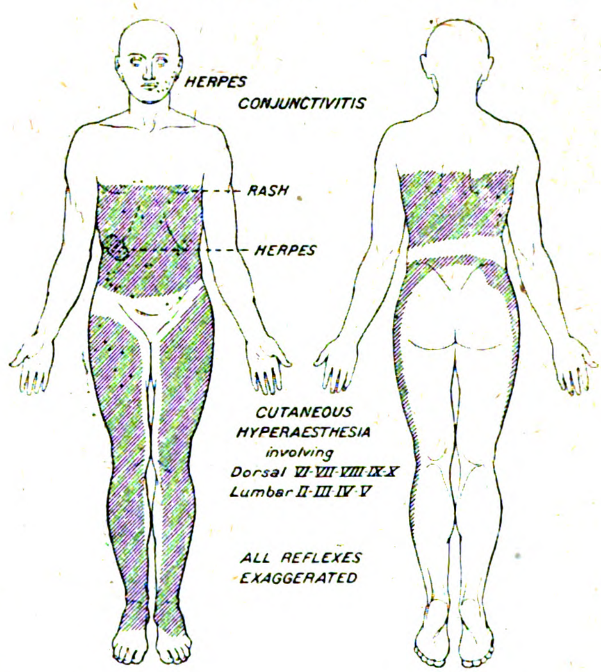
Uninoculated man, aged 27. Bacteriologically and serologically negative to past or present enteric infection. Four-hourly chart showing frequent synchronous observations upon temperature, pulse, and blood-pressure.

He was mentally alert throughout the illness. He was flushed; labial herpes and conjunctivitis were present. The tongue was practically clean throughout. The heart was normal, the apex beat being well defined. The

lungs were clear. There were several well-marked brick-red spots scattered over the abdomen, and a few similar spots on the upper and anterior surface of the right thigh. The rash, lasting some twelve hours or so but recurring in several of the subsequent relapses, in addition an herpetic eruption, appeared on the right side of the abdomen during the second relapse lasting several days.

Cutaneous hyperæsthesia was noted involving the sixth, seventh, eighth, ninth and tenth dorsal, also the second, third, fourth and fifth lumbar segments. There was tenderness on pressure in the splenic area; the spleen was not palpated. The dorsal and lumbar spines were tender on

TRENCH FEVER, TYPE "B." FIFTH DAY.



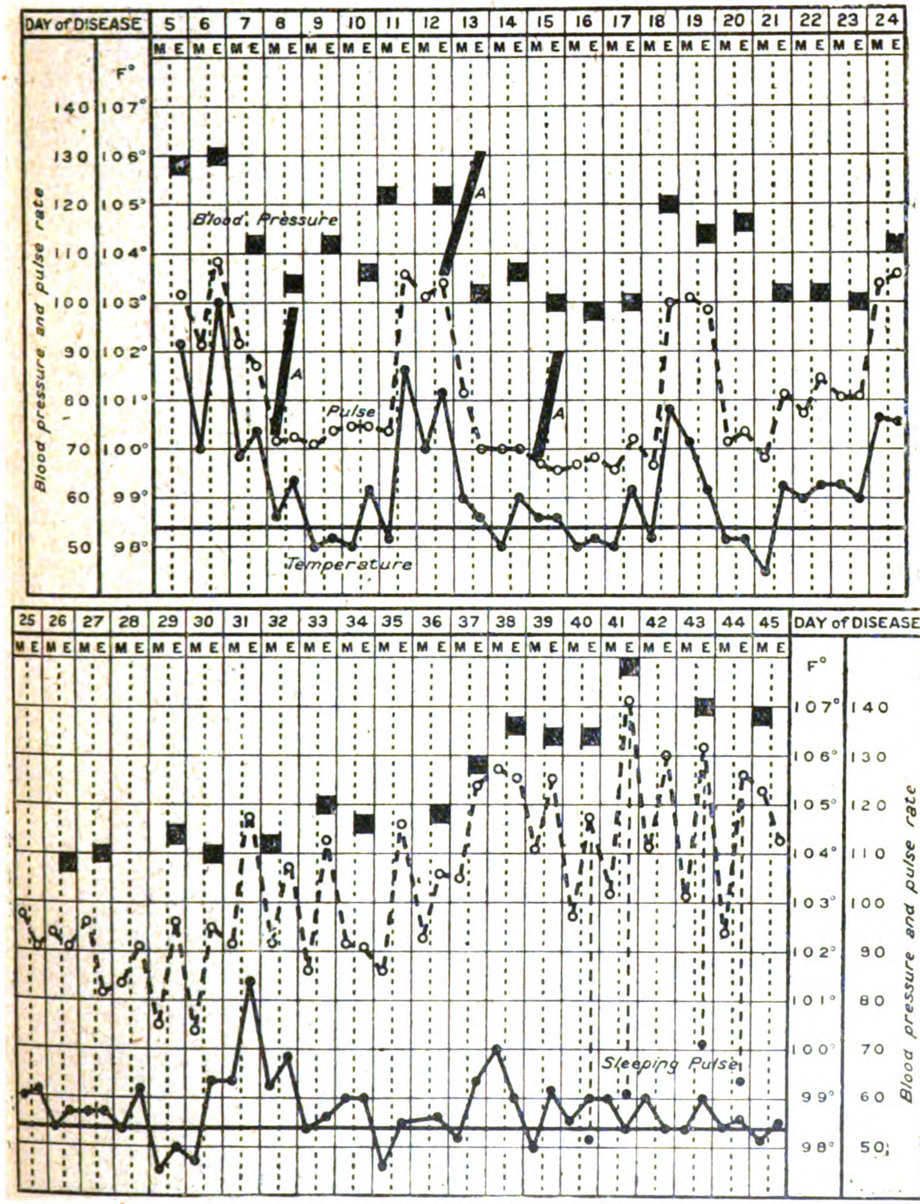
pressure. Muscular hyperalgesia was noted in the lumbar region, also in the thighs and calves. The symptoms and signs were in abeyance between the relapses, although some degree of hyperalgesia remained. The illness, the temperature, pulse, and blood-pressure curves closely followed one another; as convalescence was approached the pulse and pressure curves rose unduly. This condition was present eight weeks later when he was discharged. However, the pulse was observed to be slow during the sleeping state.

The cardio-vascular system responded in a normal manner to atropine and adrenalin. The cardio-ocular reflex was normal.

Comment.—The man was uninoculated; there was no evidence of an enteric infection. The temperature, pulse and blood-pressure curves

are co-ordinated during the acute disease, the two latter rising unduly in convalescence. There was evidence of a toxic disturbance of the sensory nervous system with peripheral trophic changes. Prior to evacuation

TRENCH FEVER, TYPE "B."



A = Acceleration of pulse-rate after $\frac{1}{50}$ grain atropin.

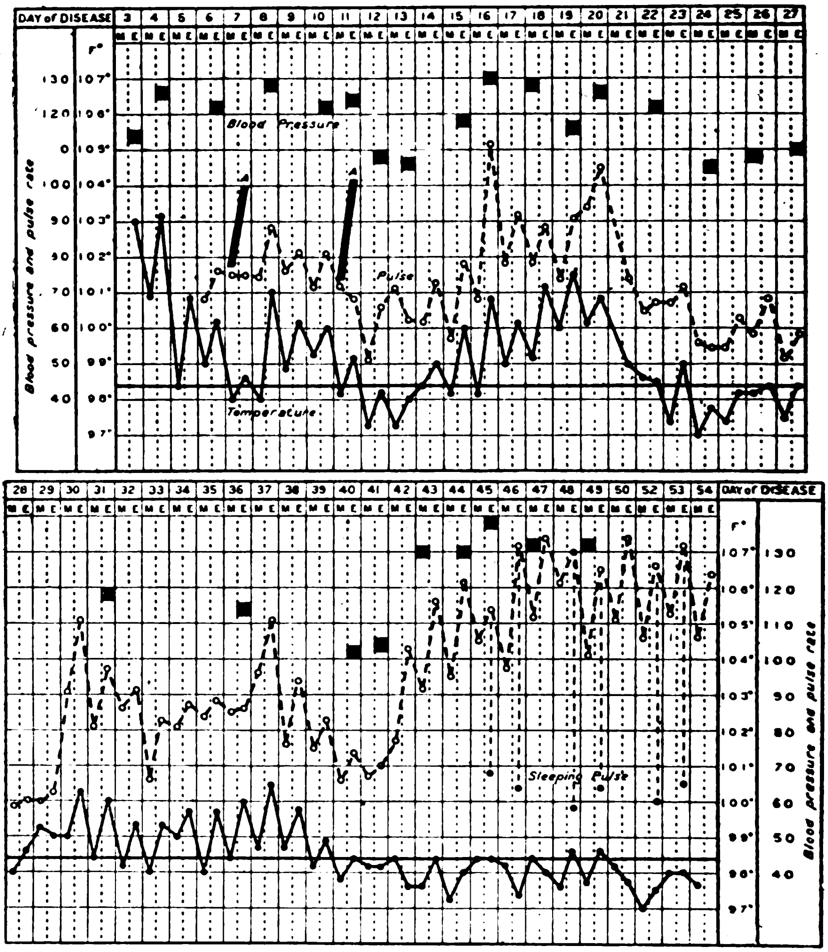
he was inoculated with T.A.B. and his blood was shown to possess agglutinins to each member of the enteric group. Clinically, the case presented many of the features observed in trench fever.

Trench Fever, Type "C."

An uninoculated man, aged 22; bacteriologically and serologically free from past and present infection by a member of the typhoid group.

Onset gradual with malaise, later frontal headache, cold shivers and a sore throat, a few days later pains in the small of the back, shoulders, arms, and in the shins, which were worse at night. He was mentally clear.

TRENCH FEVER, TYPE "C."

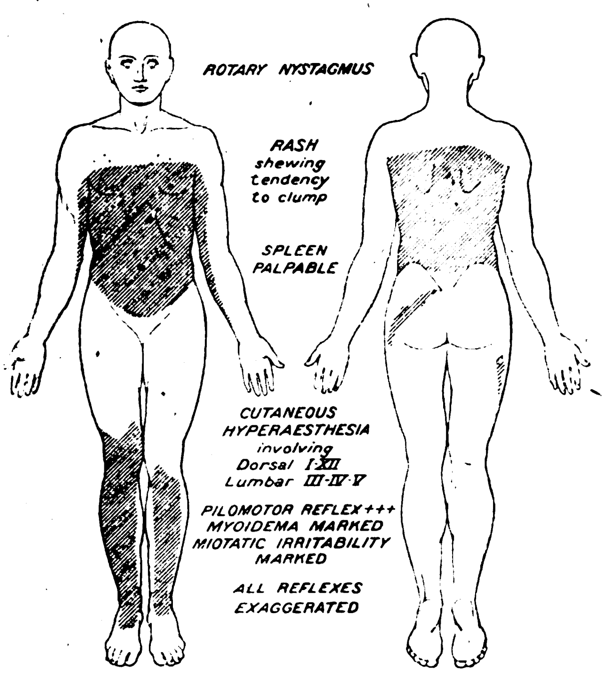


A = Acceleration of pulse-rate after $\frac{1}{33}$ grain of atropin.

There was rotary nystagmus present, also pain on turning the eyes to the side; the fauces were congested, the tongue being coated with a brownish fur. The heart was normal in all respects. There were a few moist râles at the bases of the lungs. There was a well-marked rash widely distributed over the thorax and abdomen, the spots themselves having a tendency

to appear in clumps, several fleeting crops making their appearance during the disease. The spleen was palpable throughout the first four weeks of the illness. Cutaneous hyperæsthesia was extensive in its distribution, the whole of the thoracic, the third, fourth, and fifth lumbar segments being involved. Towards the end of the acute illness the hyperæsthesia disappeared with the exception of a band which seemed to embrace the seventh and eighth dorsal segments; this persisted throughout the rest of the stay in hospital, by which time a tachycardia of 120 to 140 per minute had arisen without any other evidence of cardiac disability. The tachycardia was always absent during sleep. The cardio-vascular system

Trench Fever, Type "C." Fourth Day.



responded in a normal manner to atropine and adrenalin. The cardio-ocular reflex was normal. All reflexes were exaggerated throughout the body. Myoidema and miotatic irritability were always present. The polomotor reflex was pronounced throughout the disease.

Comment.—The man was uninoculated; there was no evidence of an enteric infection. The temperature, pulse, and blood-pressure curves are seen to move together. There was evidence of a toxic disturbance of the sensory nervous system. During convalescence tachycardia or D.A.H. was observed to arise with no further evidence of cardiac disability. Prior to discharge a small dose of T.A.B. vaccine showed

that he was capable of producing agglutinins to each member of the enteric group of organisms. Clinically he was a case of trench fever of the enteric type.

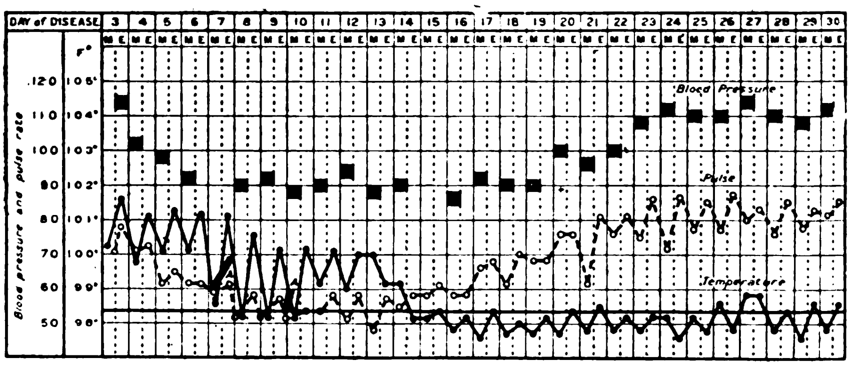
Paratyphoid B Fever.

An uninoculated man, aged 26. *B. paratyphosus* B isolated from the blood. Serologically, there were agglutinins present to the same organism.

Onset sudden: He fainted and was seized with frontal headache; later he had a little abdominal pain with diarrhœa lasting for two days. There were pains in the back and legs. He was apathetic, slightly flushed; there was no nystagmus. The tongue was thickly coated with yellowish fur—clean by the end of the fourth week. The abdomen was tumid, and scattered over the surface were several large, raised, dusky spots which lasted a few days, leaving a brownish stain on fading. The spleen was palpable during the second week of the disease.

Cutaneous hyperæsthesia was never observed either on the trunk or limbs. All reflexes were depressed, the abdominal being absent; the pilomotor both local and general was absent for several days during the second week of the disease. Examination of the cardio-vascular system showed the following points: The heart at first normal, later showed evidence of dilatation, with the appearance of epigastric pulsation, and the disappearance of the apex beat during the second week of the malady. A relatively slow dicrotic pulse was present at this time; in addition the characteristic fall in the systolic blood-pressure was noted. The cardio-vascular system became normal in all respects as convalescence was established. A hypodermic injection of $\frac{1}{33}$ grain atropine failed to quicken the heart-rate more than ten beats per minute on the seventh or tenth day, and an intravenous injection of a quarter millimetre of $\frac{1}{1000}$ adrenalin failed to raise the systolic blood-pressure on the eighth and eleventh days of the disease. The cardio-ocular reflex was abnormal, the heart-rate was unaffected.

Uninoculated. Paratyphoid B Fever.



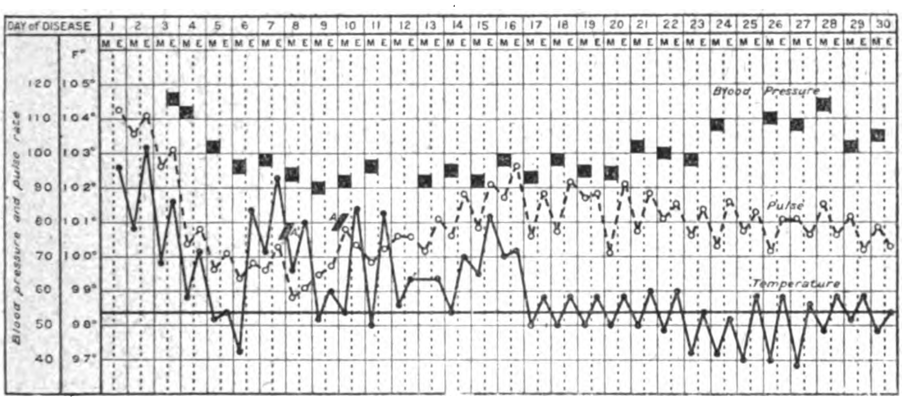
A = Acceleration of pulse-rate after $\frac{1}{33}$ grain of atropin.

Comment.—An uninoculated man with an undoubted enteric infection, with a pyrexial period closely resembling trench fever type "A," with back-ache and limb pains and an enlarged spleen. Close examination of the nervous system showed a depression throughout. Examination of the cardio-vascular system showed a fall in the pulse and blood-pressure curves in the usual way, independent of pyrexia. The response of the cardio-vascular system to atropine and adrenalin was abnormal, and was that usually witnessed in enteric infections. Amongst the 100 cases of enteric quoted in this paper seventeen had a pyrexial period of this type somewhat similar to trench fever type "A."

Paratyphoid B.

A man, aged 23, inoculated with T.V. vaccine eighteen months previously. *B. paratyphosus* B isolated from the blood and stools. Onset fairly suddenly, with faintness, loss of strength, headache, pains in the back, thighs and calves. He was admitted on the third day of his illness. He was lethargic, the eyes were suffused, there was no nystagmus; the

PARATYPHOID B FEVER.



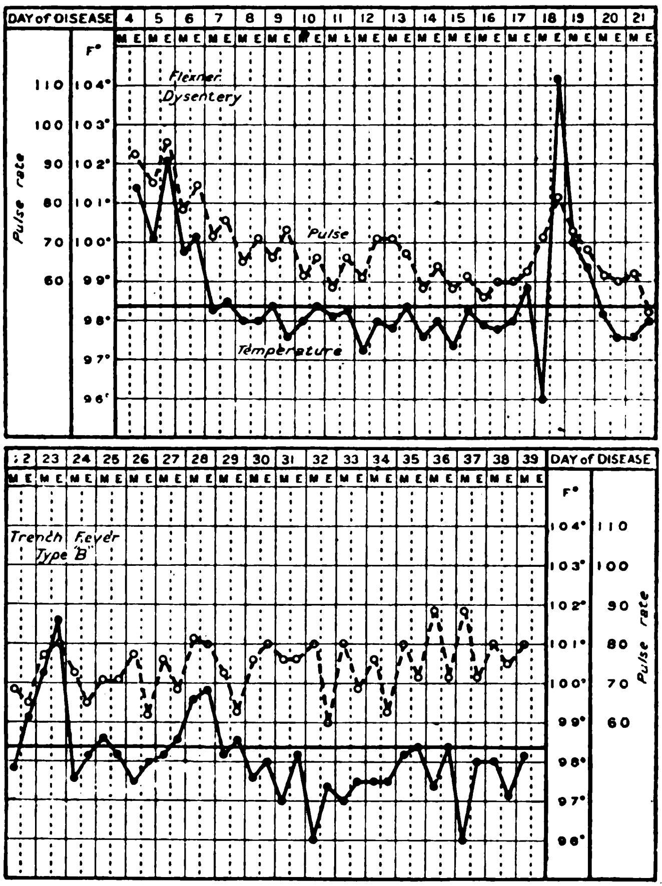
A = Acceleration in pulse-rate after $\frac{1}{30}$ grain atropine.

tongue was thickly coated with brown fur, which had not cleaned by the time of his discharge. The abdomen was doughy, there was deep tenderness about the region of the spleen. No spots were ever observed; the spleen was never palpated; there was never any cutaneous hyperæsthesia, all the reflexes were depressed, the abdominal pilomotor being absent during the second week. In the cardio-vascular system the heart was normal, a relatively slow low-tension pulse was noted for a time. The characteristic depression in the blood-pressure curve was observed, and the failure of the heart to respond to atropine was recorded on the seventh and tenth days of the disease. Adrenalin caused a rise of only 5 mm. Hg in the blood-pressure. The cardio-ocular reflex was absent.

At the beginning of the illness there was a little catarrh at the bases of the lungs, lasting a few days.

Comment.—An undoubted case of paratyphoid B fever with a temperature closely resembling trench fever type "B," with limb pains. Close examination of the nervous system showed a depression throughout, the blood-pressure curve was that commonly associated with enteric infections. The response of the heart to atropine and adrenaline was that usually seen in these fevers. Among the 100 cases of enteric quoted in this paper six had pyrexial periods of this type resembling trench fever type B.

FLEXNER DYSENTERY AND TRENCH FEVER, TYPE "B."



Double Infection.

Flexner Dysentery and Trench Fever Type "B."—A man, aged 20, who had been inoculated nine months previously with a full dose of T.A.B. vaccine, was admitted to hospital with the following symptoms: He was

suddenly seized with severe pains in the lower abdomen, followed by incessant diarrhœa with much blood and mucus in the stools. Bacteriologically he was shown to be a case of Flexner dysentery, later he was declared to be free from an enteric infection. By the seventh day of illness the temperature was normal, he was free from pain and the diarrhœa gave place to constipation; by the tenth day he was convalescent; he was to be discharged to the United Kingdom on the eighteenth day, but as he was seized with a severe headache he was detained. The same evening the temperature rose to 104° F., and he had severe pains in the shins; the tongue was clean; nystagmus was marked. By the twentieth day he was well again. Two days later the headache and shin pains returned, and the temperature again rose: in addition he was found to have a rash on the left side of the abdomen; there was cutaneous hyperalgesia covering the seventh to tenth dorsal and fourth to fifth lumbar segments; there was tenderness on pressure in the splenic region. The erector spinæ and anterior tibia muscles were distinctly tender. Within forty-eight hours the symptoms had disappeared; however, there was a further relapse on the twenty-eighth day, which rapidly cleared and he was discharged on the thirty-ninth day apparently well.

Comment.—Here is seen to occur seventeen days after the onset of a sharp attack of Flexner dysentery, an illness which possesses all the clinical features associated with the trench fever group.

A HISTORICAL INQUIRY INTO THE EFFICACY OF LIME-JUICE FOR THE PREVENTION AND CURE OF SCURVY.[1]

By ALICE HENDERSON SMITH.
(*From the Lister Institute.*)

(*Concluded from p.* 116.)

(iv) Quantity and Nature of the "Lime Juice" Ration; Methods of Preparation and Issue.

There was one point, however, that was not considered vitally important by the Committee. The source of the "lime juice" was different and may supply a key to the whole problem. Animal experiments have recently been made with Mediterranean lemons and West Indian limes, and the results of these have shown that the antiscorbutic value of the lemon is *four times* that of the lime.[1] The supreme importance of this difference in connexion with the use of the fruits in the Services is immediately obvious. The preparation and exhibition of the lemon juice supplied by the Admiralty to the Search ships of 1850 is described in detail in "Naval Hygiene and Scurvy" as follows:—

"The lemon juice with which we were supplied was of the most excellent quality, and consisted of two kinds, one of which was prepared by adding a tenth of brandy; and the other was the acid simply boiled,[2] and contained no spirit. The juice was kept in bottles, each containing sixty-four ounces, with a stratum of olive oil, about half an inch in thickness, on its surface, and the bottles were carefully corked and sealed. Previous to my departure, I received instructions from the Director-General of the Navy to adopt whatever means might seem to me most judicious, whereby I might be able to report on the relative merits of the two kinds of acids, and their efficacy as antiscorbutic agents. I therefore recommended the following plan for adoption that I might be enabled to arrive at results as accurate as it was in my power to obtain, viz., that each half of the crew should partake of the different kinds of acid.

"In pursuance of this plan it was mixed in separate tubs, from which each man daily drank his allowance in presence of an officer. The adoption of this practice was attended with the happiest results. I had thus the positive evidence afforded me that every man in the ship drank his allowance (one ounce) daily, and was thus fortified with a regular daily quantity of a powerful antiscorbutic. To this circumstance, therefore, I unhesitatingly attribute not only the immunity we enjoyed from scurvy

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[1] Chick and Hume, 1918. From a series of tests, it has appeared that a daily dose of 2·5 centimetres of fresh lemon juice will protect a guinea-pig from scurvy, while it takes ten centimetres of the fresh juice of limes to afford the same immunity. (*Lancet*, November 30.)

[2] This boiling was for less than five minutes.

for a longer time than has ever been known in the Polar Sea, but also our good fortune in maintaining an unprecedentedly high standard of health among our crew during the same period.

"The custom which has been hitherto observed in Polar ships, and which is still followed in the Navy, is to issue the lemon juice, with the necessary quantity of sugar, to the different messes into which the ship's company may be divided, in quantity proportionate to the number of men contained in each mess.

"But, although the lemon juice is regularly issued, it does not necessarily follow that it is consumed; and this plan affords no guarantee whatever that each man drinks his allowance.

" . . . In order that each man should drink his proper allowance, I proposed for adoption the plan I have already mentioned, which was very strictly carried out . . . The lemon juice on board the 'Investigator' was subject to every possible vicissitude of temperature from the highest degree of Equatorial heat, to the lowest of Polar cold, being under the influence of the latter for upwards of three years; and when I examined it at the end of this period I found it as good and pure as on the day we left England, and its power of neutralizing alkalies was not in the slightest degree impaired . . . I have previously mentioned that we were supplied with two kinds of lemon juice; one of which was prepared by adding a tenth part of brandy, the other was simply boiled, without the addition of any acid. Now, with regard to the relative merits of the juices thus differently prepared, I could detect no difference in the excellence of either from their therapeutical influence over the disease, as both appeared to me equally efficacious in their action. I remarked, however, that that which was prepared with spirit remained clear and free from deposit in the bottle, while that which was simply boiled deposited a portion of its mucilaginous constituents in the form of a heavy, dense, cloudy-looking mass at the bottom of the bottle, apparently indicating that some change had taken place, but neither its power of neutralizing alkalies, nor its therapeutic efficacy was in the least degree affected. But from the fact of this mucilaginous deposit taking place, I am disposed to give a preference to the juice which is prepared with spirit, and I consider it the best for use in Her Majesty's Navy.

"The quality of lemon juice which is used in the Mercantile Marine of this country is very much inferior to that which is in use in the Navy—which is the best that can be procured."

The lime juice used on board "Alert" and "Discovery" was given in the same way with the same precautions that each man should consume his share. *But it was juice of West India limes, not of lemons.*

Dr. Colan, Medical Officer of "Alert,"[1] says: "So far as I am aware, lime juice is procured from the lime at Montserrat, in the West Indies, and is

[1] Scurvy Committee Report.

sent home to England in puncheons. The lime juice supplied to "Alert" and "Discovery" was obtained from Messrs. Evans and Sons of Liverpool, and was delivered in the Deptford Victualling Yard and examined by a board of officers there for the Navy in general. It was packed in jars, wickered to the nozzle, each containing four gallons or 40 lbs., securely corked, sealed and capsuled. It was fortified when drawn off into the jars, which was done in April 1875, by ten per cent of the best strong Demerara rum placed in each jar, the jars then being filled up with lime juice. The lime juice was supplied to me from the ship's stores as I required it . . . It was the colour of dark brandy, quite clear."

So these two supplies of "lime juice," one of lemons and the other of limes, were preserved and put up in the same way, and different methods introduced later of preserving the juice do not come in to complicate the comparison. They were also used in precisely the same way, and the conditions in which they were used were, I have tried to show, very similar, with any advantage rather in favour of the later expedition.

(v) Value of Lime Juice in Treatment of Scurvy.

Clear evidence as to the value of the lime juice in the treatment of the cases from the "Alert" and "Discovery" is difficult to get for the same reason that must always make it so—that the patients were being given everything available that might relieve them. To quote Sir George Richards again:[1] "It is, of course, not to be expected that medical men, when called upon to give evidence, will state that they do not believe in the efficacy of lime juice as an antiscorbutic, because it is a generally received medical fact"; and when asked as to its curative value, Dr. Colan, Medical Officer of "Alert," said the men mended under it. Dr. Ninnis, of "Discovery," while subscribing to the established belief that it was the best substitute for fresh vegetables, pronounced it very much inferior thereto. Dr. Coppinger, Assistant Medical Officer in "Discovery," who had charge of Beaumont's party at Polaris Bay, alone commented on its failure to do what he expected of it. He was asked, "Have you any information which you can give the Committee which has not been elicited by their examination?" and replied, "I noticed certain peculiarities as to the effects of certain remedial agents. In the case of Chattell, to whom I gave a large allowance of lime juice from the time that he showed the first sign of scurvy, no material improvement took place in his condition until after he came on a diet of fresh seal meat. Again, in the case of Lieutenant Beaumont's crew, who suffered from scurvy, I was at first only able to administer to them lime juice in addition to such portions of the sledge fare as they could digest, and those men did not materially improve until after they got an allowance of fresh meat. Again, I might remark that two of the men of Lieutenant Beaumont's crew who suffered from

[1] Letter to *Times*, May 21, 1877.

scurvy, exhibited fresh signs of the disease after they had been for five or six days taking a liberal supply of lime juice. In the case of Jones, the stoker, a fresh outbreak of petechiæ appeared on the legs after he had been, I think, seven days taking a large allowance of lime juice. In Lieutenant Beaumont's case, a fresh outbreak of large extravasation patches appeared on the legs after he had been for several days taking lime juice, and in Shepherd's case his progress towards recovery seemed to date from the time when the weather in the spring became so mild that he was induced to take open-air exercise. He seemed to get rather worse and worse during the winter, although he was supplied with a large allowance of good lime juice, fresh meat and medical comforts of various kinds."

It would appear, then, that not all of the medical men who treated the scurvy cases of the "Alert" and "Discovery" were convinced of the infallible potency of the lime juice which was in their hands, and that in some cases, at any rate, it was not of itself, even when administered in considerable doses, sufficient to keep the disease in check. The history of its use entitled them to expect much clearer results, but previous experience was derived from the juice of lemons, not of limes.

(vi) Experience on other Ships of the Search for Franklin, 1847-1859. (See *infra*.)

It is of interest here to look very briefly at the conditions in some of the other Arctic ships and their supplies, beginning with the first of the Search expeditions.

Sir James Ross.[1]

One Winter. Bad Lemon Juice. Bad Scurvy.

Sir James Ross, with the "Enterprize" and "Investigator," wintered in Leopold harbour, North Somerset, in 1848-49. After preliminary sledging in April, 1849, the main parties went out on May 15. By that time of the year lemon juice could be taken on the sledges without its freezing, and it was taken, but scurvy developed, and on the return journey, which was begun on June 5, the men were so incapacitated with "lameness and debility"[2] that some had to be carried in, while others were only just able to walk. The ships were unable to get west through the ice in summer, were caught in the pack, and drifted down the west side of Baffin's Bay, and when released came home to England, arriving in November, 1849. Their lemon juice was examined on their return, and was found to lack nine parts in ten of the proper acid content. It is not

[1] *References.*—"Parliamentary Papers," 1850, XXXV; 1852, XXX, p. 317. Dr. Robertson's Report in "Scurvy Committee's Report," 1877. Dr. Robertson's *Journal* in Public Record Office, and letters and reports there. "Victualling in the Royal Navy, Past, Present and Future," Inspector-General Alex. Turnbull, M.D., 1903.

[2] The dreaded word scurvy was avoided, and men who had been on this voyage examined by the Scurvy Committee in 1877 said there had been debility but no scurvy.

surprising that, thus deprived of their trusted prophylactic, they succumbed to scurvy.

This most unfortunate expedition was victimized by the hideous callousness of the contractor who supplied their preserved meat. In buying the preserved meat which was now taking the place in the Navy of some of the salt junk, it had been found to be much cheaper to get it in Rumania where cattle were cheaper, and large contracts were made in 1845 and again in 1850, with a man called Goldner, of Galatz, whose agent in London was one George Blogg, of Houndsditch. The meat supplied was satisfactory. But when a Polar expedition was to be catered for, special purchases were made, in order that supplies of superior quality should be secured for it. Here was Goldner's opportunity. Arctic voyagers were too far off to interfere with his contracts and their return was uncertain; and the tins for these ships were filled with putrescent meat and offal. The salt meat these ships had was also bad in quality and deficient in quantity. Providentially, the expedition got a great number of sea-birds and eggs in early summer, so their case was not so bad as it would otherwise have been, but by the time they were nearing England there were few men in the whole expedition who were not more or less affected by scurvy.

It is possible, even probable, that Franklin, too, had deficient lemon juice. We know he had Goldner's meat, and it appears from the correspondence about it in the Record Office, that it was delivered late, the ships actually having to wait for it—a way of securing that there was the least possible chance of its being examined.

"*Plover*," 1847-1854.[1]

Seven Years. Varying Provisions. Varying Health.

Commander T. E. L. Moore sailed in the "Plover" in January 1848, a few months before Sir James Ross, for Behring Strait, hoping to meet and support Sir John Franklin's ships. The "Plover" was out until 1854 as depot and communicating ship, but she was constantly reinforced and her sick men replaced by others, so that she is not exactly comparable to the ships that were dependent on their own resources solely. There are, however, several interesting points in her history.

She got fresh vegetables, brought from the Sandwich Islands each summer, and in 1851 purchased from a Sydney vessel four months' supply of fresh potatoes at one pound per head per day. The idea of freezing these potatoes to preserve them was at first put aside as it was the common opinion that potatoes were spoiled by frost, but when the experiment was made it was found to be perfectly successful. When frozen through and kept frozen, they remained perfectly good and the crew got a certain supply of them the following winter. They were issued daily, half a pound

[1] Medical Journals, "Plover," 1847-1854. Public Record Office.

and one pound on alternate days, and while they lasted there was no scurvy. (This information does not seem to have been applied in later voyages; might it not also be applicable to fresh lemons?)

Another interesting fact is this: Men who were invalided or wished to leave the Arctic service were replaced in 1850 by men from the "Herald," who had been surveying for four years in the tropics. These men succumbed to scurvy when the "Plover's" men were immune. The same thing occurred in 1851; fourteen scorbutic men from the "Plover" were exchanged for fourteen fresh men from the "Herald," and it was again the "Herald's" men who were afterwards the worst cases of scurvy, the disease occurring only in a comparatively mild form in the "Plover's" men who had been out since the beginning of 1848. By this time the "Herald" had been five years in the tropics, and her provisions were old and very bad. Presumably she was revictualled from victualling stations very remote from home, and in 1850 and 1851 she supplied the "Plover," which was also thus heavily handicapped. Fortunately the "Plover" was never entirely dependent on ship supplies or some of her many scurvy cases might probably have ended fatally. Her vegetables and frozen potatoes were of course a source of strength while they lasted, and considerable quantities of berries and wild onions were found near some of her anchorages.

Of lemon juice only half an ounce per man was issued daily, except in the treatment of actual cases. Wherever it is spoken of by the surgeon it is spoken of favourably, but that it was not so good as the 1850 juice is apparent from the time it took to effect cures, and from the fact that the surgeon used citric acid (thirty grains, twice or thrice daily) and was satisfied that it was equal to the lemon juice. This opinion is at variance with that repeatedly formed by others, when citric acid was compared with the 1850 lemon-juice.

In 1853 the "Rattlesnake" came out from England bringing stocks of quite fresh provisions, and between that summer and the following one when the "Plover" left the Arctic zone, no scurvy occurred on board of her, except in the case of two men after a long journey in the ice. These fresh provisions probably included the fresh lemon juice. During this winter, 1853-54, they also had four pounds per head per week of saurkraut and four ounces of cranberries. The lemon juice ration was half an ounce throughout.

Collinson, 1850-54.[1]

Four Winters, Three in Ice. Good Lemon Juice. Very little Scurvy.

The serious failure in provisioning Sir James Ross's ships ensured the utmost possible care being given to the supplies for the next expedition, and when the same ships "Enterprize" and "Investigator" sailed again

[1] *Proc. Roy. Geog. Soc.*, 1855. Medical Journals and Letters, Public Record Office.

in January, 1850, it was under very different conditions. Excellent supplies, uniformly reported on in the most favourable terms when the ships returned, and the fresh lemon juice, gave them every chance, and although the conditions of their service were extremely severe, the health record was exceptionally good.

On getting through Behring Strait, in summer, 1850, Captain Collinson attempted to get straight north into the Arctic Sea, but was stopped irresistibly by the ice, and by the time he extricated his ship it was too late to go east that year and he had to get into winter quarters. He went south and wintered at Hongkong. In spring, 1851, he went up Prince of Wales Sound, but found that McClure had been before him; and again when he started to go up the west coast of Banks Land he found that McClure had already searched that part too. He then went east, searching the coasts of Prince Albert Land, where he wintered in 1852-53, and Victoria Land, where Cambridge Bay was his next winter quarters. He contemplated the possibility of trying for a North-West passage by Peel Sound, but found that by some mistake in the outfitting at home, he was very short of coal and must of necessity take his ship to some locality where fuel was to be found. The winter of 1853-54 was therefore spent on the Canadian Coast, in longitude 145° W., and he came home in 1854.

Lemon juice was issued on board in the usual way to the messes, not as in the "Investigator," where every man was bound to swallow his own share. The ration was one ounce daily. Slight scorbutic symptoms appeared in the first winter "in the warrant officers and ice-mates," but these "yielded at once to the action of a few doses of lemon juice." The total number of cases of scurvy on the sick list was twelve, of whom two died; in four men on the list for other complaints there was also scurvy, and five men were slightly affected without having to leave their duties. This is surely a remarkable immunity for the five years of the ship's commission in such conditions. The crew were fortunate in getting a fair supply of fresh meat at the various anchorages, and at Cambridge Bay a lot of salmon.

Austen's Expedition, 1850.[1]

One Winter. Good Lemon Juice. No Scurvy.

Captain Austen, in the "Resolute," with "Assistance" (Captain Ommaney) and "Pioneer" and "Intrepid" as steam tenders, went out in early summer, 1850, returning in autumn, 1851. These ships had the fresh, newly issued lemon juice, squeezed at Deptford, which was issued to the messes in the usual way, and one ounce daily. Mr. Bradford,

[1] *References for Austen and Belcher Expeditions.* Parliamentary Papers, 1852, L, 1854, XLII. Journal of Medical Officer of "Resolute." A. R. Bradford, Public Record Office. Journal of Medical Officer of "Assistance," David Lyall, Public Record Office Report of the Scurvy Committee, 1877.

surgeon of the "Resolute," recommending an increased allowance for future ships of preserved potatoes and lemon juice, says he is satisfied that several of the men of his sledging party in 1851 showed "some of the premonitory symptoms" of scurvy. In his list one entry occurs under Scorbutus, and is "discharged to duty," but he does not mention that or any other case, or refer to scurvy in any way in his journal, so presumably it was negligible.

The "Assistance" had no scurvy, and the officers say of the whole expedition that they "never heard of scurvy"—"the idea of scurvy never entered our heads." No fresh meat at all was served to the ship's company of the "Assistance" during the winter, and it was only after the spring sledging that they got birds and eggs in considerable quantities.

These ships were out as long as the "Alert" and "Discovery" were in 1875-76.

Sir Edward Belcher, 1852-54.[1]

Two Winters. Good Lemon Juice. Little Scurvy.

The same vessels went out again in 1852, under Sir E. Belcher, who was himself in command of the "Assistance," with "Pioneer" (Lieutenant Osborn), while the "Resolute's" commander was Captain Kellett, with "Intrepid" (Lieutenant McClintock), and the "North Star" (Lieutenant Pullen), acted as store and communication ship at Beechey Island.

"Assistance" and "Pioneer" wintered, 1852-53, in Northumberland Sound, Wellington Channel (76° 52′ N., 97° W.). It was a peculiarly barren spot, the steep limestone hills having no vegetation and therefore no game, and the crews would not taste the flesh of the few bears they killed. The following summer (1853) they failed to get the ships south to Beechey Island, and they wintered, 1853-54, fifty-two miles north of it, on an exposed shore. They had no fresh meat at all during their two winters, so that all who were on board these ships remembered particularly that the "Phœnix" (out in the summer under Inglefield) sent them eighty looms for their second Christmas dinner, not quite one bird for each man. They had no sorrel or scurvy grass; of mustard and cress they grew enough to issue it on three occasions each winter, one ounce to each man, and the sick got a little more. Three of their men showed slight scorbutic symptoms in the first year and they had several cases in the second winter. One man died of scurvy on the "Assistance," who had been confined below for a long time with other complaints, and a man died on the "Pioneer."[2]

[1] *References for Austen aud Belcher Expeditions.* Parliamentary Papers, 1852, L, 1854, XLII. Journal of Medical Officer of "Resolute." A. R. Bradford, Public Record Office. Journal of Medical Officer of "Assistance," David Lyall, Public Record Office, Report of the Scurvy Committee, 1877.

[2] This from Medical Journal of Dr. Lyall, of "Assistance," but Dr. Toms, of "Pioneer," denies in 1877 that scurvy caused this man's death.

By the time they joined the "North Star" in the summer of 1854, many showed signs of incipient scurvy.

The "Resolute" and "Intrepid" spent their first winter (1852-53) at Dealy Island, Melville Island, and their second in Melville Sound, not far from Cornwallis Land. They seem to have been more fortunate in regard to game than most ships, their total bag being 28,000 pounds weight. Of fresh vegetables "Resolute" had very little scurvy-grass or sorrel and no mustard and cress; "Intrepid," a small quantity only of mustard and cress grown on board, no sorrel or scurvy-grass. These ships had no scurvy. Again the officers say "scurvy never entered our heads." Very long sledging expeditions were carried out without lemon juice and without any scurvy at all.

The "North Star" had no symptom of scurvy during her two winters and three summers at Beechey Island. Her crew had no game or very little, but they seem to have been more successful than some ships in the growing of mustard and cress, of which they produced enough to issue a small quantity as often as once a week. The medical officer, Dr. McCormick, reviewing his whole experience, says: "In three voyages, one of them of four years duration, to the Antarctic, embracing every possible transition of climate and exposure, I have never lost a single life or even had a serious case of sickness or scurvy throughout a Polar service falling little short of seven years"; and Lieutenant Pullen, who commanded the "North Star," says: "I do not think I ever in my life met with scurvy." It will be remembered that he left the "Plover" on his boat expedition in 1849, before scurvy developed on that ship.

"*Prince Albert*," 1851-52.[1].

One Winter. Source of "Lime Juice" unknown. Bad Scurvy.

Another ship of this period must be recorded because it suffered severely from scurvy—the "Prince Albert," one of Lady Franklin's own ships. Lime or lemon juice of some sort the ship must have had, but what it was, where they got it, and how it was issued, are not recorded. It was certainly not the Navy lemon juice, for Captain Kennedy specially speaks with gratitude of the Admiralty having supplied him with a ton and a half of pemmican; if he had also had his lemon juice from the Admiralty, he would have mentioned it too. Very impure lemon juice was then being sold to sea-going ships, and the ration that was legally compulsory was then only half an ounce.

McClintock, 1857-59.[2]

Two Winters. Navy Lemon Juice. Little Scurvy.

The "Fox," the last of Lady Franklin's ships, and the ship that finally established the fate of Franklin and his crew, went out in 1857 under Sir

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[1] "A Short Narrative of the Second Voyage of the 'Prince Albert,'" W. Kennedy, 1853, *Proc. Roy. Geog. Soc.*, vol. XXIII.

[2] "The Fate of Franklin and his Discoveries." Sir F. L. McClintock, 1859. Report of the Scurvy Committee, 1877.

Leopold McClintock, with Lieutenant Hobson and Captain Allen Young. She was supplied with lemon juice by the Admiralty. Caught in the ice in Melville Bay in August, the year being exceptionally unpropitious, she spent the whole of her first winter in the ice pack drifting down Baffin Bay towards the Atlantic, and freed herself only in April, 1858. After a second winter, spent in Bellot Strait, some extremely strenuous sledging was done.

There were in all five cases of scurvy. One man died who had disliked potatoes and refused to eat them ; he had also eaten only salt meat, preferring it to the preserved fresh meat; and he had been in charge of the stores and had drunk more spirits than his share. Of the others, Lieutenant Hobson's was the only bad case. He had voluntarily foregone his lemon juice ration for some time on board ship as there was a fear of the supply running short.

The Grinnell Expeditions.[1]

(I) *Lieutenant de Haven. One Year. Lemon Juice not used. Bad Scurvy.* (II) *Dr. E. K. Kane. Two Years. Lemon Juice not used. Bad Scurvy.*

Two American expeditions, equipped by the generosity of Mr. Grinnell of New York, took part in the search for Franklin; the first in 1850, in the "Advance" and the "Rescue," under Lieutenant de Haven, U.S.N., with Dr. Kane, U.S.N., as medical officer.

These ships, after meeting in Barrow Sound with eight other vessels all engaged in the search, went up Wellington Channel, where they were caught in the floe. In it they were drifted east and south until April when they were released far down Davis Strait. In spite of scurvy they tried to get back to Wellington Channel in the summer of 1851, but were detained by the ice in Melville Bay so long that they had to give up the attempt and return home.

The American Navy did not use lime juice as a regular ration and these voyages were not exceptional in this. Dr. Kane did use it in his treatment of cases of scurvy, but what fruit exactly it was expressed from, whether lemons or limes, does not appear. It is quite likely to have been limes, because the sour lime has always been used in the States much more than in Europe, and is largely preferred to the lemon; and also, at this time the British medical officers were speaking of their supply as "lemon juice," which it was, while Dr. Kane speaks of his as "lime juice" and is not less likely to speak exactly. Whatever it was, he did not value it highly as fresh fruit juice, and in his treatment "used freely an extemporaneous citrate prepared from our lime juice." The American safeguard was raw

[1] "U.S. Grinnell Expedition in Search of Sir J. Franklin." Dr. Elias Kent Kane 1852. "Arctic Exploration: The Second Grinnell Expedition." Dr. E. K. Kane, 1856.

potatoes sliced up and mixed with molasses. Molasses was long valued highly in the British Navy, too, and it was the one of the earlier issues believed to be antiscorbutic, that was not given up on the introduction of lemon juice. The amount of sugar issued to the sick a hundred years ago was amazing; but as one of the first signs of a scorbutic diathesis is loss of energy, sugar as a quickly assimilable energy food was possibly of use in increasing resistance to the disease. Unrefined molasses may also have retained some vegetable properties from the sugar cane. It was used in many ways in American ships.

De Haven's ships went out in May; scurvy is first mentioned by Dr. Kane so soon as the end of September. They had quantities of game at Beechey Island in August and September, but thereafter it all vanished, and in the later months seals were eagerly watched for on account of the sick. By Christmas shortness of breath was general; the appetites of all had changed, and they developed the same increasing desire for fats noticed also on the British ships. "Ham-fats, and sauerkraut swimming in olive oil were favourites." They had beer brewed on board, and they had also, as our men had not, sauerkraut and butter. They dreamed of fruit. They seem to have had as much fruit as our men, or more, but most of it was evidently dried, which may be more destructive than the process by which it is preserved in tins. By January the Commander was so ill that he had to delegate his duties. In February, twelve cases of swollen gums are recorded, and stiff and painful limbs were general. By the beginning of May they had finished all their antiscorbutics, but by that time seals and walrus were again available.

In May, 1853, the "Advance" again sailed, with Kane as Commander, and a total complement of twenty, the object being to search Smith Sound for the missing ships. She wintered in a small bay on the Greenland shore (78° 37′ N., 70° 40′ W.) By February, 1854, Kane says "scurvy and general debility have made me short o' wind," and speaks of the "scurvy spots that mottled our faces," showing a pretty advanced stage of the disease, and in March only two men were exempt. They had had meat in summer but through the winter were rarely successful in the hunt. All on board fared alike and he gives the daily menu: "For breakfast, tack (biscuit), pork, stewed apples frozen like molasses-candy, tea, coffee, with a delicate portion of raw potato. Dinner, the same as breakfast, but without tea and coffee and with pickled cabbage and dried peaches. Six o'clock supper, something like breakfast, something like dinner, only a little more scant." Their antiscorbutic was not effective, in the quantities available, neither was it so palatable as the British one. "At dinner, as at breakfast, the raw potato comes in, our hygienic luxury. Like doctor-stuff generally it is not appetizing as desirable. Grating it down nicely, leaving out the ugly red spots liberally, and adding the utmost oil as a lubricant, it is as much as I can do to persuade the mess to shut their eyes and bolt it, like Mrs. Squeers' molasses at Dotheboys Hall. Two absolutely refuse to taste it. I tell them of the

Silesians using its leaves as spinach, of the whalers in the South Seas getting drunk on the molasses which had preserved the large potatoes of the Azores—I point to this gum, so fungoid and angry the day before yesterday, so flat and amiable to-day—all by a potato poultice; my eloquence is wasted; they persevere in rejecting the admirable compound."

In spring, 1854, a preliminary sledging party went out to lay depots, but broke down badly owing to the severity of the cold. This was followed by several amputations for frost-bite, and two men died of tetanus thereafter. The main search parties went out at the end of April, but the scurvy that had been with them all winter, but had been relieved by fresh meat in spring, at once broke out again, as well as the obscure tetanoid symptoms that had also appeared through the winter. Finally, Dr. Kane was carried back to the brig "nearly insensible and so swollen with scurvy as to be hardly recognisable," his condition then being regarded as almost hopeless. There remained only three men able for ordinary duty on the ship. Now, however, there came abundance of animal life, fresh sorrel was found, and the conditions on the ship improved rapidly.

The intention was to finish the search of Smith Sound and to go south when the ice broke up, so no stores were laid in during the time of plenty for a possible second winter. The ice did not break up. The position of the ship's company became very grave, and when the Arctic night settled down life on board the brig resolved itself into a long daily struggle at close quarters with disease. The Esquimaux were unable to help, as it was with them too a year of famine, and their own extremity great. In March, 1855, only three of the voyagers, including Kane, were able to leave their bunks, and these three were very ill; and it seemed as if none of them could survive, when an opportune supply of walrus was secured, and thereafter the occasional irregular bag of fresh food was only just enough to carry them through until the return of comparative plenty.

They left the brig in May, with sledges and boats, carrying those who were still disabled, and after many dangers reached the Danish settlements, where they were picked up by ships sent out by America to seek them.

A later American[1] expedition went up Smith Sound in 1871, in the "Polaris" under Captain Hall, and it was from depots left by them that Lieutenant Beaumont got supplies of lime juice in 1876. The "Polaris"[2] had fresh seal meat all winter in their bay on the Greenland coast (81°N.) in what must surely have been an exceptional season, so whatever their use of lime juice may have been, it is not surprising that scurvy is not mentioned in the report of the expedition. It was from this ship that nineteen people lived on the ice-floe for six months (1872-73) without illness.

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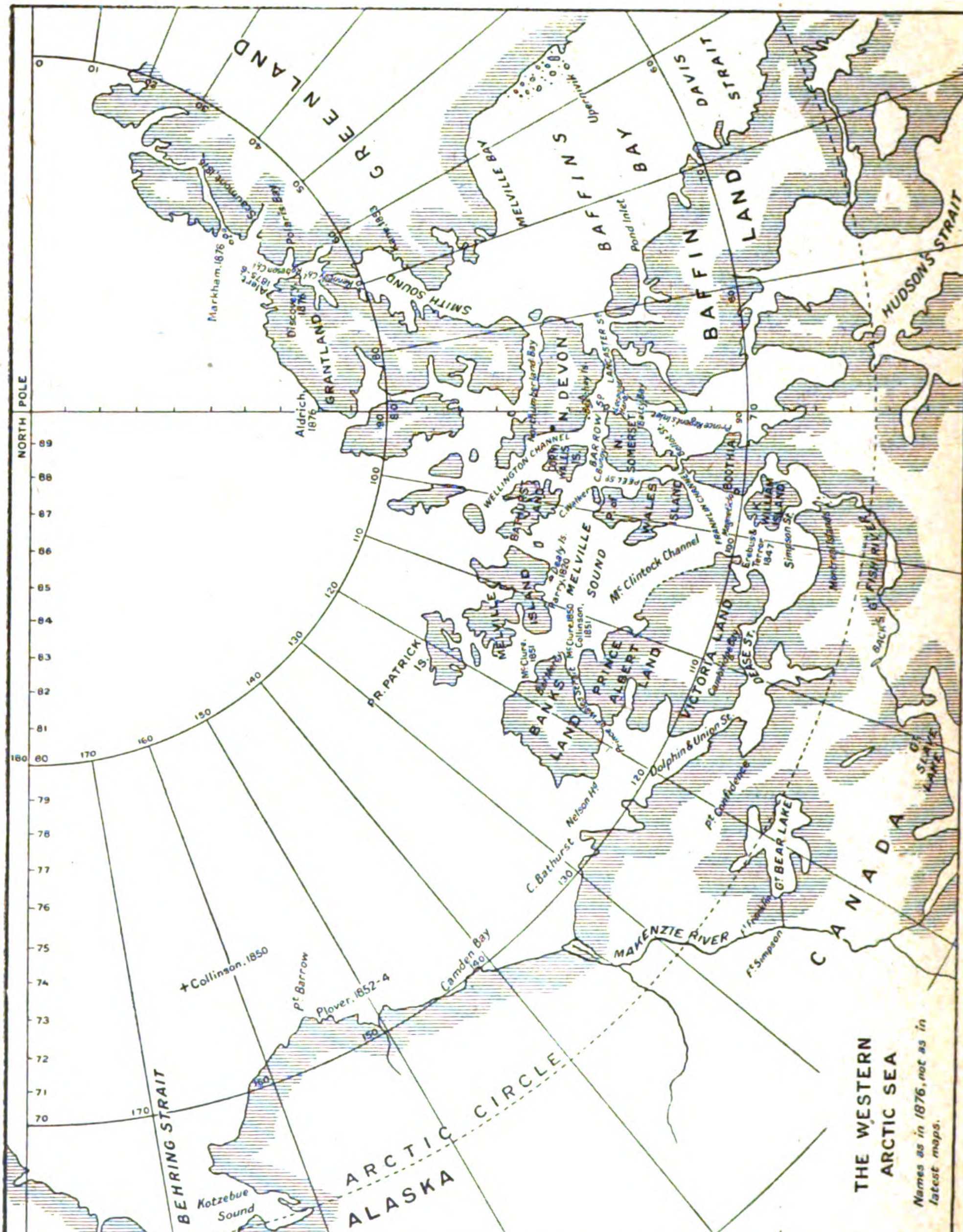
[1] Report of Secretary of U.S. Navy.

[2] Statement of the Esquimaux hunter, who was with Nares, later: "A Voyage to Polar Seas," p. 304.



THE WESTERN ARCTIC SEA

Names as in 1876, not as in latest maps.

(vii) Evidence of the Antiscorbutic Value of Lime Juice afforded by the Experience of Recent Arctic Explorations; Influence of Improved and Ampler Diet.

In recent expeditions the importance of lime juice is much reduced by the greater variety in the general diet. Merely an ampler and more varied diet, apart from the greater quantity of directly recognizable antiscorbutics it may contain, assists the patient's forces in resisting scurvy. It is a commonplace of everyday experience that variety makes food more grateful and more relished and that the interest and appetite decline before monotony. On those ships, where even the change from night to day is not, monotony must obtain to a nightmare degree hardly realizable by those who have not experienced it, and the importance of mere change of diet is noted again and again by Arctic officers. Also the extra demands due to Arctic conditions require certain things in greater proportion than elsewhere. For instance, fats seem to have been wanted in all cases and there is a general agreement among witnesses examined by the Scurvy Committee that the addition of butter and preserved milk would be a very great improvement in Arctic diet.[1] Several officers spoke of having experienced "a sort of craving" for fat as well as for fresh meat, e.g., Captain Hobson of the "Rattlesnake" and the "Fox," and Dr. Toms of the "North Star" and the "Pioneer."

The scurvy patients in the "Alert" and "Discovery" were cured, those who survived, on the ship's resources and it is to be remarked that they began to improve on "Alert," before fresh meat was available for them.[2] They were of course given all that the ships' stores and medical comforts could produce to vary and improve their diet. Early in the treatment fresh meat was added and their improvement was rapid; but besides fresh meat and fish, and sorrel, and the mustard and cress grown on board, Dr. Colan's report says, "Potatoes were given every day, as also pickles. Cabbage frequently, and fruits according to circumstances. For breakfast and tea and sometimes for dinner I drew on the medical comforts for apple jelly, oysters, milk, boiled fowl, extract of mutton . . . port wine, sherry, brandy . . . and on the ship's stores for ale. . . . A firkin of butter was given by the officers to the men which was much appreciated. Some American hams left by the "Polaris" were distributed and liked."[3]

The ampler and more varied diet of the officers compared with that of the men, on "Alert" and "Discovery," might account for the corresponding difference in resistance to scurvy. The same contrast was apparent on

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[1] Chick, Hume and Skelton, found in their work that the addition of milk (heated to destroy antiscorbutic vitamines) to the "scurvy" diet of their guinea-pigs improved the condition of the animals, and maintained their weight, although the onset of scurvy was not prevented. (*Biochemical Journal*, 1918, vol. xii, p. 131.

[2] Nares. "A Voyage to Polar Seas," vol. ii, p. 2.

[3] Scurvy Committee's Report, p. 400.

board the "Investigator." After communication had been established with the "Resolute," McClure asked for volunteers from his people to spend another season on his own ship in the ardent hope which all shared, of eventually bringing her through. All the officers felt fit to do so and volunteered (except Sainsbury who died soon after), but only four of the men were able for it. On board the "Plover," the gunroom officers were never touched with scurvy, and it is noteworthy, too, that in the scurvy outbreak in Hungary in 1720, during the war between Austria and Turkey, the officers were not affected; but with the Grinnell expeditions, where men and officers shared the same diet, they suffered equally from scurvy. Dr. Kane mentions in February, 1851, that then only five out of his twenty-four men had not ulcerated gums and blotched limbs, and of these five four were the cooks and stewards. And the cooks on board the "Plover" were also less affected than the rest of the crew. Scurvy has in fact been called a disease of the forecastle since at least the time of Dr. Lind, who says,[1] "Officers are seldom or never affected with scurvy; even the subalterns and petty officers generally keep free from it while it commits great ravages among the common seamen."

Since, then, the patients on the "Alert" could begin their cure, and since the officers could be protected, by supplies carried on board the ship, an improvement of the general diet was indicated for the protection of the whole crew. So, on lines suggested by the evidence given before the Scurvy Committee, the victualling of later exploring ships has been much enlarged. Lime juice had been relied on and had been found surprisingly wanting; it was therefore depended upon less, and a fuller and more varied diet, with a greater proportion of antiscorbutic food, again took some of the responsibility from it.

But the early ships were *very largely* dependent for their protection on their lemon juice, and it was barely protection enough. We have seen that the Grinnell ships did not use it, and had scurvy badly both times; that the British ships they were alongside of in 1850 did have lemon juice and did not have scurvy; that Sir James Ross's ships in 1848-49 had deficient lemon juice and did have scurvy; and that an individual officer suffered directly for the withdrawal of the protection, when Lieutenant Hobson took the risk upon himself for the general good of the ship's company of the "Fox." Recent experiments have demonstrated that the antiscorbutic value of the fresh juice of the lime is one quarter of the value of the fresh juice of the lemon.[2] By substituting lime for lemon juice, the protection is reduced by three-fourths, and what before barely sufficed to ward off disease now fails completely and the men are at its mercy. Later elaboration of processes of preparation, entailing a long

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[1] Dr. James Lind. "Treatise on the Scurvy." Third Edition, 1772.

[2] Chick, Hume and Skelton, *Lancet*, November 30, 1918.

delay between the plucking of the fruit and the use of its preserved juice, have reduced still further the efficacy of the lime juice, but it is *from the date of the change from lemons to limes that a change begins in the historical evidence as to its value.*

Already on the "Alert" and the "Discovery" the men have lost faith in it, and Dr. Coppinger is quoted[1] as having said that he depended more on fresh meat than on lime juice in his treatment. This is a long step from the belief of twenty years earlier. Read, beside it, Dr. Armstrong's letter of October, 1854, to Sir William Burnett: "I had recourse to it (lemon juice) in all the scorbutic cases with the utmost confidence . . . . on it I placed the greatest reliance, it was my unfailing hope, and as long as I could command a liberal supply I was never disappointed in the anticipated results."[2] In 1894 the Jackson-Harmsworth expedition[3] offered another test. Having left the exploring party on Franz-Joseph Land, the ship "Windward" was to return home, but was beset in the ice and her crew had to pass the winter of 1894-95 in Arctic conditions, for which they were not specially prepared. They refused to eat the bear meat that kept the land party in good health, and lived on ordinary ship's stores, salt and preserved meat, with a daily ration of lime juice; all the crew developed scurvy and three died of it.

Again,[4] in 1895-96, in the Chitral garrison, every man was affected with scurvy more or less severely "in spite of our having a good supply of so-called lime juice." (Herbs were found, however, which stopped the ravages of the disease.)

Lime juice had thus failed repeatedly, and questions came up again, as they had done a hundred years before, as to the nature of scurvy and the cause of it, but with the answer of that day now ruled out. Indeed, the line was taken that scurvy cannot be caused by the absence of vegetable food, and was argued thus :—

> Lime juice is equal to vegetable food;
> But lime juice does not prevent scurvy;
> Therefore vegetable food does not prevent scurvy;
> Therefore its absence cannot be the cause of scurvy.
>
> Q. E. D.

Every kind of theory as to its cause had been put forward at some time or other—that it was caused by the "heat of aire,"[5] or by enforced celibacy,[6] or even that citric acid caused it.[7] Now the fresh vegetable theory

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[1] Fleet Surgeon Gilbert Kirker, in discussion, British Medical Association, 1902.

[2] Medical Department. In—letters, Public Record Office.

[3] "A Thousand Days in the Arctic," F. G. Jackson, 1899.

[4] "Letter of Lieutenant-Colonel Hamilton, I.M.S., *Brit. Med. Journ.*, October, 1902.

[5] Woodall, "The Surgeon's Mate," 1617.

[6] Surgeon Gillespie's Diaries, 1785-1803, Public Record Office.

[7] Stevens, quoted by Pereira, "Materia Medica."

seemed to have gone the way of all the others and the real cause was still to seek. Dr. Turnbull,[1] Dr. Koettlitz,[2] Medical Officer of the "Fram," the "Windward" and Scott's "Discovery," Mr. Jackson and Dr. Harley,[3] following Professor Torop of Christiania, attempted to demonstrate that scurvy was a chronic form of ptomaine poisoning. But the contention produced a new crop of interesting evidence,[4] all on the lines of a hundred years before, that it was still due to the absence of fresh vegetable foods, and was immediately curable by their addition to the defective diet.

But in the meantime our National Antarctic Expedition was equipped and provisioned on the chronic-ptomaine idea, and when scurvy appeared in September, 1902, fourteen months after the expedition left England, it was matter for amazed surprise, and the officers were quite unable to account for it in any way, as their provisions were apparently perfectly sound. What Captain Scott did, replacing all tinned meat as far as possible with fresh seal meat, increasing largely the use of bottled fruits, and growing mustard and cress as much as the conditions permitted, was in any case the best course he could take. The scurvy was got under, although Lieutenant Shackleton was in grave danger from it later, while travelling in December, and so ill that presently he had to come home on the relief ship.[5] The expedition was fully and generously equipped with West India lime juice by the gift of Messrs. Evans, Lescher and Webb, but by this time there was no question of compulsory consumption,[6] as it was not supposed to have, and had not, any special merit.

In all the recent investigations, the change in the fruit from which the "lime juice" was expressed was not observed or was taken to be immaterial. Moreover, the methods of preparation have been altered; and in the over-preparation, in the mere passage of time after all vital processes have been stopped and vitamines are no longer being produced, the virtue is destroyed. And so the juice of *limes*, prepared by a slow process which further reduces its already inferior properties, continues to this day to be accepted as the same as the fresh juice of *lemons* that protected Lord St. Vincent's fleet in 1801. Just such was the history of malt in the Navy. Fresh malt (that is, germinated barley) air-dried, was used for the prevention of scurvy at the end of the eighteenth century, in fresh infusions and in small beer, and it was useful; and a century later we find the tradition then formed

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[1] "The Prevention of Scurvy," Inspector General Alex. Turnbull, M.D. A discussion in the section of Navy, Army, and Ambulance, British Medical Association, 1902, pub. *Brit. Med. Journ.*, 1902, vol. ii, p. 1023.

[2] *Brit. Med. Journ.*, February 8, 1902.

[3] *Proc. Roy. Soc.*, April 14, 1900.

[4] e.g., Lieutenant-Colonel Hamilton, I.M.S., *British Medical Journal*, October 25, 1902.

[5] Voyage of the "Discovery," R. F. Scott.

[6] Medical aspect of "Discovery's" Voyage. *British Medical Journal*, 1905, vol. ii, p. 77. Dr. E. A. Wilson.

still clinging round the fined ales, made by a slow process from kiln-dried malt, that were carried instead by the Arctic ships. Spruce-beer, too, in which fresh leaves were at one time a real antiscorbutic, was made later, in complete disregard of its origin, without the fresh leaves. Such also was the course of history when green vegetables were reputed the sovereign remedy. Immediately, people produced and offered to the Admiralty preparations of dried vegetables, soup preparations with herbs, &c., which were experimented with, and the same sort of thing is being advocated to-day. Dried potatoes have certainly by many years' experience proved their worth in high latitudes, but an attempt to replace in general green vegetables with the dried forms would eventually lead to the discrediting of vegetables as a whole, in their turn, and we should be back again at the beginning. In what we called "lime juice" we had at one time a "precious medicine." Not recognizing the arbitrary eccentricities of the genus citrus, we have altered the source of our "lime juice" as well as the manner of its preparation and preservation, and we have not realized that we were altering essentials, so long as we still had "lime juice." Yet, in the reign of James I, John Woodall said "*In want of lemons*, use limes."

Scurvy need never occur again in Arctic service. The same care and precision may be applied to the production of fresh pure lemon juice that is now devoted to an inferior substitute for it, and our explorers again be protected as was the Navy in its dire need a century ago. Add to that the present perfection of food preparation and the full and varied diet devised for recent travellers. And add the new knowledge that if the dry pulses they have always carried, in ignorance, alas, of their potential value, are allowed to germinate before being cooked, they have in them an anti-scorbutic food of real importance,[1] akin to the fresh malt of Captain Cook's voyages. The frosts of five Arctic winters will not kill the germ,[2] so here is at hand in a very simple form, a considerable additional safeguard. The "Investigator's" men in their five years must have consumed something over 16,000 pounds of dried peas—waving acres of vitamines, had they but known. The "Alert" and "Discovery" returned into Deptford Stores, 6,000 pounds, enough to have given them constant rations of fresh growing vegetable food. Scott's "Discoverers" might by this means have turned the balance well in their favour. How much distress might have been averted all along, had they but known!

Scurvy need never occur again in Arctic service. That was said before "Alert" and "Discovery" sailed; it was said again when Scott's

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[1] Fürst, 1912, confirmed by Chick and Hume, 1917. Wiltshire, *Lancet*, December 14, 1918.

[2] The Smithsonian Institute sent out with Captain Hall on "Polaris," 1871, a quantity of test samples of grains which were left in depot at Polaris Bay. They were brought home by Nares in 1876, and some grown at Kew (of which sixty-two per cent germinated); the rest were returned to the Smithsonian Institute, Washington. "A Voyage to Polar Seas." Nares, vol. i., p. 340.

"Discovery" sailed. Now we are getting back on only rather more logical lines to the empirical wisdom of a hundred and twenty years ago. We have worked round in a circle away from the truth by our confidence in our knowledge, and back again through hard experience; and it may be that in a long term of immunity we shall again forget or learn to misapply the facts so hardly gained. Until our knowledge of scurvy is more exact than it is to-day, such a thing is still possible. But at least it is with a confident hope, as well as in profound gratefulness that we may now believe that that terrible chapter of suffering has been finally closed.

Summary.

There is a strong traditional belief in the value of lime juice for the prevention and cure of scurvy. Recent investigation has however demonstrated that the lime juice now issued to the Services is without antiscorbutic potency, and it has become important to examine the origin of the tradition and to find out how it was justified. The discrepancy between the merit of the former and the failure of the present issues is explained by the facts recorded in this paper.

On going back to its earliest use in the Navy, we find that "lime juice" was introduced in the last years of the eighteenth century, its use being extended until 1804, when it became general. Its value then was immense and indubitable, and it then established firmly the reputation that has lasted for over a century. But, although often called "lime juice," it was in fact chiefly the juice of lemons, and any limes that may have been used at first, with the lemons, were the sweet limes of the Mediterranean, and not the sour limes now used for the preparation of the juice. From 1804 until after 1860 all the juice used by the Navy was the juice of lemons from Malta and Sicily. With the employment of lemon juice, and the simultaneous improvement in the men's conditions that followed the mutinies of 1797, scurvy gradually disappeared from the Naval surgeons' lists. So successful was its use in the Navy, and so much loss was averted by it, that it was eventually made compulsory in the Merchant Service too, by the Act of 1844 (confirmed in 1854), which provided that lime or lemon juice should be given to the crew of every ship after they had been for ten days on salt provisions. The Merchant Shipping Amendment Act of 1867 doubled the compulsory ration and history continues to show the value of it.

There was difficulty in securing the purity and soundness of the supplies of lemon juice for the Navy, but the greatly improved provisioning of the Service rendered this the less important, because scurvy seldom had an opportunity of developing. The deficiency of the supply, and the gravity of the consequences of that deficiency were demonstrated, however, by the first of the expeditions in search of Sir John Franklin, in which severe scurvy developed. The lemon juice supplied was found to be so greatly adulterated as to lack nine parts in ten of its proper acid content. The utmost care was therefore taken to provide pure fresh lemon juice for the succeeding expedi-

tions, and these show an almost complete immunity from scurvy. Later, the development of the cultivation of the lime in the West Indies gave an opportunity for securing a supply of pure acid juice, produced under the most favourable conditions, and by 1875 the Admiralty had transferred its contracts from Malta, and substituted the juice of *limes* for that of *lemons.* But the sour lime of the West Indies (*Citrus medica acida*) happens to have only *one quarter* of the antiscorbutic value of the lemon (*Citrus medica limonum*). That fact has been shown by recent experimental work, but was not then suspected. The West India lime juice answered satisfactorily to all chemical tests and was believed to be superior to the old lemon juice. Practical tests of the value of the issue became more and more rare, with the introduction and increasing use of steam power, which shortened voyages generally beyond the possibility of scurvy. But polar exploration still gave its opportunity, and the first Arctic expedition that went out furnished with the lime juice was that of Sir George Nares on the "Alert" and the "Discovery," 1875-76, which suffered from scurvy in great severity. On the return of these ships to England a Committee was appointed to inquire into the cause of this outbreak, and they returned a finding that it was due to the failure to send lime juice with the sledge travellers. The publication of this opinion was greeted with protests from the Secretary of the Royal Geographical Society and from Arctic officers of long experience, and its untruth was demonstrated. Former Arctic expeditions had not sent lemon juice with their sledges and had not had scurvy; men of the "Alert" and "Discovery" who did not go with the sledges but remained on board ship and continued to drink lime juice, also developed scurvy; and moreover, premonitary scorbutic symptoms had appeared pretty generally before the sledges went out. The finding of the Committee failed to explain the outbreak.

The conditions, diet, &c., of these ships are compared above, in detail, with those of the ships of the Franklin Search, and especially with those of the "Investigator," Sir Robert McClure's ship, that had the longest term in polar seas. The "Investigator" went out in January, 1850, and her first case of scurvy showed in May, 1852, twenty-seven months after she left England, and seven months after her principal rations had had to be reduced to two-thirds. The "Alert" and "Discovery" left England in May, 1875, and the first case of scurvy occurred in January, 1876, the general development of it in April, eleven months after leaving home, the ships' companies being all the time on full rations. The lemon juice and lime juice on the two expeditions were prepared in the same way and issued in the same way and in the same quantities, and their diet shows no important variation, except in favour of the later ships. The one significant difference is in the source of their antiscorbutic, and the ship protected by lemon juice has a long immunity, while those protected by lime juice succumb early to the disease. The examination of the history of other ships with *lemon juice* confirms the conclusion suggested by that of the

"Investigator." And later cases of the use of *lime juice* are shown to demonstrate further its limitations.

The general diet of later expeditions has been so enlarged and improved that they are no longer so dependent on the lime juice, but wherever weight is leaned upon it, it fails. Incidentally, numerous illustrations are given of the importance of fresh meat in the prevention and cure of scurvy.

Later methods of preparing and preserving lime juice have taken from it what value it originally had; but it is from the change in the fruit used that the change begins in the history of its merit as an anticorbutic; and the discrepancy between the worthlessness of the lime juice of the present day and the undeniable value of the juice issued at the end of the eighteenth century, and during the first half of the nineteenth, is due chiefly to the fact that the modern issue is derived from the West Indian sour lime, while the earlier was the juice of lemons.

A NOTE UPON THE MODES OF INFECTION IN BACILLARY DYSENTERY.

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In the autumn of 1916 there was a relative lull in the pressure upon the medical staff in Alexandria, and the opportunity was taken to investigate some of the methods by which the infection of bacillary dysentery was conveyed from one individual to another. The investigations were interrupted by press of work before they were completed, and no further opportunities have been available. They are thus incomplete, but as we have been unable to find any other data upon the subject in the literature that is available to us, we have thought it right to publish them even in their incomplete form.

Source of infection : Infected stools.

Possible methods of infection: (1) Water; (2) Sand; (3) Food; (4) Flies; (5) Fingers.

The source of the infection is the stools of an infected person. It has been stated that dysentery bacilli do not persist for long in the stools of patients who are suffering from the disease. In a general way the statement is true, for the organisms are most frequently isolated during the early days of the illness, and may not be detected even in cases where blood and mucus are still present. In one of our cases no dysentery bacilli were isolated after the fourth day, though blood and mucus persisted in the stools until the ninth day. In another blood and pus persisted until the eleventh day, though bacilli were absent after the ninth day. But, on the other hand, they may persist after the blood and mucus have disappeared, and even when the stools are normal.

In fifteen out of twenty-eight cases in which the stools were examined repeatedly, bacilli were found in the second week; and in three cases in the third week of the disease. In one case they persisted until the eighteenth day, and were found subsequently on the twenty-fifth day. In three cases they disappeared after the fourth day.

Their presence too, or, at any rate, their recognition, may be intermittent. We have found them present on the fourth and fifth days, absent on the sixth, and present on the eighth and ninth; present on the sixth and seventh days, absent on the eighth, and present again on the ninth. It is evident, then, that they may persist in the stools for a considerable period.

It seems probable, too, that the figures which we have just mentioned are below the maximum. We examined the stools of 100 patients at

Montazah, who had gone there when convalescent from an attack of dysentery, and were at the time in good health. The stools were only examined once, but in eight cases were found to contain dysentery bacilli. It is of course possible that a re-infection had occurred at Montazah, but it is probable that in some, at any rate, of these cases the infection had never been eradicated, and still persisted.

It must be borne in mind that diarrhœa may be the whole evidence of a dysenteric infection. A man was admitted into hospital on December 21, 1916, on account of diarrhœa which had ensued two days previously. He said that he had passed some blood and mucus on the morning that he was admitted, but the stools after admission were always fæcal, and without addition, and after December 26, 1916, formed. The number of stools passed daily after admission was 3, 1, 1,—1, 1, 1, 1, but that of December 23 showed on culture the presence of dysentery bacilli.

It is also probable that, owing to the intermittency of excretion of these organisms in sufficient number to be detectable by the ordinary methods, the number of carriers among dysenteric convalescents is higher than the above figures indicate.

Dysentery bacilli may be present in the stools of men who have never had any symptoms of gastro-intestinal disturbance. A man in the steward's store at a general hospital was found to have a dysentery bacillus in his stools on September 20, 1916, and on October 11, 1916. He had been on the Peninsula from September until the evacuation, and subsequently in Egypt, and would not admit that he had ever had any diarrhœa or dysentery since he came East. He had only been off duty through ill health on one occasion, June 1916, when he was sick for a fortnight with "inflammation of the lungs."

The majority of the carriers whom we discovered had, however, suffered previously from diarrhœa or dysentery. In one case the patient stated that he had had diarrhœa for a couple of days immediately before the stool—a normal one—was examined. In another an attack of dysentery had occurred eighteen months previously, but no intestinal disturbance of any kind had been present in the preceding nine months. In most cases some history of antecedent diarrhœa or dysentery was obtainable, a history which is usual among all ranks in Egypt, though in most cases the illness is of a trivial character.

Dysentery bacilli, then, occur in the stools of men who are suffering from diarrhœa or dysentery, or who have in the past suffered from these diseases; and also in the stools of healthy individuals who have never had at any time symptoms of gastro-intestinal disorder.

The proportion of carriers is appreciable, and as their stools may be normal or abnormal, every stool is potentially infective unless proved not to be so, and the strictest precautions should be taken to ensure the complete disinfection of every stool at the earliest possible moment after it is passed.

We have found that, though dysentery bacilli tend to die within seven or eight hours in stools kept at ordinary temperatures, both the Shiga and the Flexner types may survive for twenty-four hours in dysenteric stools kept at room temperature. A stool must therefore be regarded as infective for a considerable period after it is passed.

The methods by which, in Alexandria, the infection is conveyed to the healthy individual are probably numerous, and vary in different cases. A general source seems unlikely, for the dysentery of the last eighteen months, though considerable, has never been of epidemic type. Patients coming from the same camp or unit are rarely from the same tent or mess, and in general we have conceived the impression that the personal habits of the individual are largely concerned with the incidence of the disease. This impression, which we obtained in the wards, seems to be strengthened by the results of our investigations.

(1) *Water.*—The water supply of Alexandria is derived from the Mahmoudieh canal, which is grossly contaminated above the point at which the supply is obtained. The detail can be readily seen by riding along the bank, especially in the early morning. The contamination is excessive in the vicinity of Nouzha Gardens, where the river boats tie up for the night.

The bacterial content of the water is large, particularly with regard to coliform organisms; but, on the other hand, the crucial experiment of experience has shown that no epidemic of dysenteric disease, such as would arise from contamination of the water supply, has ever occurred under the present regime. The numerous cultures which we have made have never revealed the presence of any dysenteric organisms.

In some experiments upon the viability of *Bacillus dysenteriæ* we have found that these did not survive for more than forty-eight hours in the *unfiltered* water of the canal, which is grossly contaminated with coliform organisms.

(2) *Sand.*—The gross contamination of the open ground in and around Alexandria suggested that the sand might be infective. On reflection this seemed improbable, for the maximum incidence of dysentery is in the autumn, and does not coincide with the maximum incidence of Khamsin winds (in the spring) when dust storms are most frequent, and water and food most thoroughly impregnated with dust. We have procured specimens of sand from various places, including the filthy latrine grounds near the Catacombs, Pompey's Pillar and the Anfouchy Catacombs, but the bacteriological examination has never revealed dysentery bacilli. We have found by experiment that sand artificially contaminated with *B. Shiga* and exposed to the sun was sterile after six hours. *B. Flexner* survived for twenty-four hours, but had died out before forty-eight hours.

It seems possible, however, that sand may occasionally convey the disease, as we have found *B. coli* in three specimens of sand, and *B. fæcalis alkaligenes* in two.

(3) *Food.*—The bacteriological examination of the ordinary foodstuffs seemed impracticable, and was not attempted. Our only information is with regard to the milk, which we have examined repeatedly, with uniformly negative results. It is, however, invariably grossly contaminated with coliform organisms, which in some cases, at any rate, are probably due to the addition of water.

The incidence of dysentery is, however, so frequently the sequel to a meal in town that the connexion between the two can hardly be ignored. On the other hand, many of our patients had had no opportunities of eating outside of their camp, so that infection must have occurred within it.

(4) *Flies.*—Considerable stress has been laid on contamination of food and drink by infected flies. Any one who has seen a plague of flies, such as obtained at Bloemfontein in the May of 1900, and on the Peninsula and Mudros in the summer of 1915, can readily understand that such a method of infection is possible if infected stools are exposed in the vicinity of foodstuffs. No real plague of flies has, however, occurred in Alexandria during the summers of 1916 and 1917.

We have made some experiments on this point. We fed flies upon dysenteric stools, and succeeded in isolating the corresponding organism from plates which the fly was allowed to walk on and contaminate by the same method that it would naturally contaminate food. The flies were enclosed in Petri capsules containing MacConkey's medium, and retained there for one to two hours. (This method has been found satisfactory by one of us in the study of the infectivity of flies infected with *B. typhosus* and the paratyphoid organisms.) The proportion of successes was not great.

We have performed the same experiment, without success, with flies caught in the latrines of dysentery wards. Abundant contamination of the plates with coliform organisms, however, was generally observed; and in some cases colonies of *B. Morgan*, *B. proteus* and *B. fæcalis alkaligenes*, the characteristic concomitants of *B. dysenteriæ*, also developed.

We have also experimented in the same way with "wild" flies, caught in the native quarters. No dysentery bacilli were isolated.

We are not inclined to lay much stress upon infection conveyed in this way, more especially as the methods adopted to limit the numbers of flies in the vicinity of the camps, and to hinder their access to the food and drink of the troops, have been attended with relatively satisfactory results.

(5) *The Personal Equation.*—During the summer and autumn of 1916 a few cases of recurrence of dysenteric symptoms occurred in patients in the dysentery wards who had more or less recovered from their original attack. In some cases it seemed probable that the symptoms were due to a relapse of an imperfectly cured infection, but in two cases a fresh infection seemed the probable cause. In one of these the latter theory seemed

certain as the original attack had been amœbic. Our investigations were in consequence turned towards the conditions in the wards.

At first sight one might imagine that dysenteric wards and their annexes must be largely infected with the specific organisms. The contamination of the bedding, floors, bedpans, latrines, etc., is continuous and considerable and difficult to disinfect. But the danger is recognized and combated, and to our satisfaction we found that the aerial flora of the wards and annexes did not comprise dysenteric organisms. They were, too, absent from the dust of the floors, the seats of the latrines, and the bedpan racks. The patients who suffered from fresh attacks were particularly helpful in the wards, removing bedpans, etc., after use, and it seemed probable that some defect in the disinfection of their hands had been the cause of their illness, the infection having been conveyed directly when smoking cigarettes, etc., or indirectly through the foodstuffs.

Some further investigations were made with regard to this same point. A certain number of cases of dysentery occurred in a small camp. Cultures were made from the dining-room tables, the cook house, meat safe, etc., but all with negative results. An inagglutinable Shiga bacillus was, however, isolated from a tin mug in use in the canteen. In this camp two out of fifty-three men examined proved to be carriers.

The personal equation requires further attention and investigation. The washing of hands after going to the latrines and before meals, though impossible in the field, is generally possible in standing camps. Men are often notoriously careless in the cleansing even of their own knives, forks and spoons, which, when dirty, afford excellent nutritive material for bacterial growth. We have found men brushing their teeth and shaving in the sluice rooms of the wards, where infectivity is likely to be maximal. Infected hands may convey the infection to an indefinite number of people, if employed in the cook house or the dining-room. Direct personal infection is a factor that requires more attention than it has received in the past.

Examination of stools of healthy individuals :—

Source	Number examined	Positive
General Hospital, orderlies	60	4 (*B. dysenteriæ* M.F.)
Army Service Corps, Motor Transport, personnel	53	2 (*B. dysenteriæ* M.F.)
Dysentery convalescents in convalescent hospital	100	8 (*B. dysenteriæ* M.F., 4 ,, N.M.F. 4)
Native prisoners in Hadra jail	100	1 (*B. dysenteriæ* M.F.)

Specimens of sand from—	Number examined
General Hospital: camp, tents, latrines, cookhouse	6
Standing camp: camp latrines	8
Latrine ground near Pompey's Pillar, catacombs, Anfouchy catacombs	8
Standing camp: camp, baths, horse lines	6
Horse camp: camp, dining room, horse lines	6
	34

	Number examined
Swabs from—	
Standing camp: dining room, cookhouse, meat safe, tin mug	7
Dysentery wards: water closet, bedpan rack, bedpans	10
Dust—Morning sweepings of wards and latrines	3
Aerial Flora—	
Plates exposed in dysenteric wards and latrines	16
Flies—	
Fed upon dysenteric stools	13
Caught in latrines of dysenteric wards	3
Caught in Native quarters	56

We must acknowledge our indebtedness to the late Colonel F. M. Sandwith, Consulting Physician, E.E.F., for his assistance in procuring us much of the material which we investigated.

HÆMOQUINIC ACID—A NEW DISINTEGRATION PRODUCT OF QUININE PRESENT IN THE URINE, ESPECIALLY IN "BLACKWATER" FEVER.

(War Office Investigation.)

By Staff-Serjeant M. NIERENSTEIN, D.Sc., Ph.D.
Royal Army Medical Corps.

The urines secreted after the administration of quinine, which had been investigated in the Malaria Laboratory of the 4th London General Hospital, were mostly light in colour; but occasionally dark-coloured urines were also observed. Out of 854 specimens analysed, 126 were dark-coloured (corresponding to 14·76 per cent), which suggested the possibility of the presence of some disintegration product of quinine in these urines. They were therefore investigated for kynuric acid, since the latter is supposed to cause the dark colour of the urine of the dog, and also since the formation of kynuric acid from quinine could have been expected. Out of the 126 specimens fifty-three were examined for kynuric acid, but in none of those was kynuric acid found. Ellinger's[1] method for the isolation of kynuric acid was used for these investigations. The extension of this method, in a somewhat modified form to that used for "blackwater fever" urines, led, however, to the isolation of a new disintegration product of quinine. This new substance shows *pronounced hæmolytic properties* towards human and sheep blood-corpuscles, which led to the provisional designation "hæmoquinic acid."

Method of Isolation of Hæmoquinic Acid from Blackwater Fever Urine.

The urine is evaporated to dryness under strongly reduced atmospheric pressure, and the residue is dissolved in a little cold water and filtered. The filtrate is again evaporated and the residue dissolved in strong hydrochloric acid. A solution of a ten per cent phosphotungstic acid is then added until no more precipitation takes place. The precipitate is collected and decomposed with a ten per cent baryta solution, or sodium hydroxide solution, and the filtrate evaporated to about one-third of its volume. Hæmoquinic acid begins to crystallize out after about twelve hours standing, and is purified by several crystallizations from dilute alcohol. Inoculation with a small crystal of hæmoquinic acid hastens the crystallization. Hæmoquinic acid crystallizes very typically, as shown in the accompanying photomicrograph.

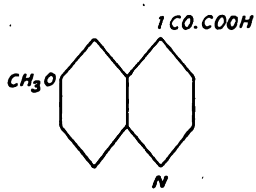
Hæmoquinic acid melts sharply at 183°, carbon dioxide being evolved. When warmed with conc. sulphuric acid, carbon monoxide is evolved. With *Herapath's* reagent for quinine a beautiful blue solution is obtained

[1] Ellinger, *Zeitschr. f. physiol. Chemie.*, 1904, vol. xliii, p. 325.

by which it is possible to detect hæmoquinic acid in dilution of 1 in 5,000. Better results are obtained if *Jörgensen's* modification of *Herapath's* reagent is used and the excessive iodine removed with a drop of chloroform.[1]

Hæmoquinic acid yields a picrate which melts at 224° C. Two combustions were made:—

		Average[1]
C =	66·56, 66·74 per cent	66·56 per cent.
H =	4·58, 4·36 ,, ...	4·47 ,,
N =	6·40, 6·48 ,, ...	6·44 ,,



The *sulphate* of hæmoquinic acid crystallizes from water in small silky needles. The analysis of the sulphate gave sulphuric acid = 30·65 per cent.[2]

The urines of thirteen blackwater fever cases were examined: they came from the malaria wards of the Fourth London General Hospital and other hospitals. These results are summarized in Table I.

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[1] By this method it was possible to detect hæmoquinic acid in the sera of two "blackwater fever" cases, kindly provided by Captain W. Fletcher, R.A.M.C., University War Hospital, Southampton.

[2] It is possible that hæmoquinic acid is 3-methoxy-quinoline-γ-keto-carboxylic acid, which requires C = 66·98 per cent, H = 41·8 per cent, and N = 6·52 per cent. The sulphate requires sulphuric acid = 31·30 per cent.

TABLE I.

Serial No.	Amount of urine investigated	Amount of hæmoquinic acid recovered	Melting point of hæmoquinic acid Deg. C.	Melting point of picrate Deg. C.
1	Not known	Not known	183	224
2	1,140 c.c.	0·24 grm.	183	223
3	130 ,,	0·03 ,,	183	220—223
4	200 ,,	0·14 ,,	183	223
5	1,160 ,,	0·24 ,,	183	220—222
6	120 ,,	Nil	—	—
7	5,090 ,,	0·36 grm.	183	222—223
8	2,360 ,,	0·12 ,,	182	223
9	3,370 ,,	0·32 ,,	183	223
10	1,880 ,,	0·22 ,,	183	221—223
11	2,650 ,,	0·12 ,,	183	222
12	1,840 ,,	0·28 ,,	183	222—223
13	2,640 ,,	0·26 ,,	183	224

In addition to "blackwater" urine the following urines of malaria cases were also examined: (1) Mixed urines of patients who were having quinine; (2) urines of patients soon after the rigor; (3) urines of patients some time after the rigor (see Table II).

TABLE II.

	Amount of urine investigated	Amount of hæmoquinic acid recovered	Melting point of hæmoquinic acid Deg. C.	Melting point of picrate Deg. C.
Mixed urines	42,000 c.c.	0·3 grm.	183	223
Rigor urines	21,000 ,,	0·18 ,,	183	222—223
Non-rigor urines	8,400 ,,	Nil	—	—

These investigations suggest a possible relationship between the formation of hæmoquinic acid in the organism and the production of "blackwater." This relationship would be a specific "quinine idiosyncrasy," since, apparently, in "blackwater" fever hæmoquinic acid is produced in larger quantities than in ordinary malarial rigor cases, the ratio being 578 in 1.

In conclusion, the author wishes to express his thanks to Colonel Sir Ronald Ross and Lieutenant-Colonel Sir Nestor Tirard for their kind permission to publish these results.

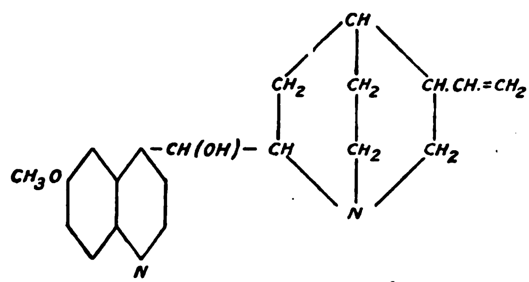
QUITININE—A DISINTEGRATION PRODUCT OF QUININE FOUND IN THE URINE.

(*War Office Investigation*).

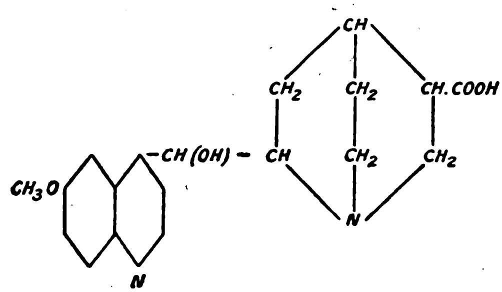
By Staff-Serjeant M. NIERENSTEIN, D.Sc., Ph.D.
Royal Army Medical Corps.

The observation of *Kerner*[1] that quitinine (formula II) is found in the urine after the administration of quinine (formula I), has been contradicted by *Merkel*[2] and also by *Giemsa* and *Schaumann*.[3] Investigations carried out by the author in the Malaria Laboratory, 4th London General Hospital, have, however, confirmed *Kerner's* observations. It was found that quitinine is present in the *early stages* of the excretion of quinine.

I.



II.



(*a*) Method of Isolation of the Quitinine from the Urine.

About 130 litres of the urine from a normal individual, which had been collected during the first two to three hours after the oral administration of quinine sulphate, were treated with a 0·3 per cent solution of picric acid and the precipitates collected. The carefully dried precipitates were

[1] Kerner, *Arch. f. d. ges. Physiol.*, 1869, p. 200.
[2] Merkel, *Arch. f. experim. Pathol. u. Pharm.*, 1902, vol. xliii, p. 165.
[3] Giemsa and Schaumann, *Arch. f. Schiffs- u. Tropen-Hyg.*, 1907, vol. xi, p. 29.

dissolved in absolute alcohol and fractionated with water. Out of 52 grm. of the picrate five fractions were thus obtained.

Fraction I	..	..	..	0·8 grm.
,, II	..	..	..	22·6 ,,
,, III	..	..	..	11·6 ,,
,, IV	..	..	..	16·4 ,,
,, V	..	..	..	Traces

The investigation of the fractions II and III after removal of the picric acid showed it to be unchanged quinine, whereas fraction IV proved to be quitinine.

(*b*) Investigation of the Isolated Quitinine.

The quitinine obtained from the urine crystallized from dilute alcohol in prisms which melted up at 281—282° C. when quickly heated, carbon dioxide being evolved. The melting point of quitinine is given as 286° C. (Skraup[1]). At 110° C. it loses water of crystallization (found H_2O—21·56 per cent calculated $C_{19}H_{22}N_2O_4 . 4H_2O$—21·05 per cent). On combustion the following data were obtained :—

Found				Calculated from $C_{19}H_{22}N_2O_4$
C—65·8, 66·2 per cent	..	..	..	C—66·7 per cent
H— 7·8, 7·2 ,,	..	..	..	H— 6·4 ,,
N— 8·1 per cent	..	..	..	N— 8·2 ,,

(*c*) Comparison between Quitinine isolated from Urine and Quitinine prepared according to Skraup's Method.

		Quitinine from urine		Skraup's quitinine
Appearance ..	..	Small prisms	.. ..	Small prisms
Melting point ..	..	283°—284° C.	.. ..	281°—282° C.
Mixed melting point	..	281°—282° C.	.. ..	281°—282° C.
Rotation	..	$[\alpha]^{D}_{17} = -122{\cdot}6°$ C,	..	$[\alpha]^{D}_{17} = -118{\cdot}4°$ C.

(*d*) Comparison between Quinine and Quitinine.

		Quinine		Quitinine
Thalleo-quinine test	..	Positive	..	Positive
Herapath test ..	..	,,	..	Not definite
Tanret's turbidity	..	,,	..	Positive, however not as delicate as quinine
Battandier's test..	..	,,	..	positive
Fluorescence ..	..	,,	..	,,
Robertson's test ..	..	,,	..	Not definite
Picric acid ..	..	,,	..	Positive

In conclusion, the author wishes to express his thanks to Colonel Sir Ronald Ross and Lieutenant-Colonel Sir Nestor Tirard for their kind permission to publish these results.

[1] Skraup, *Monatsch. f. Chemie.*, 1893, vol. xiv, p. 431.

Clinical and other Notes.

TREATMENT OF STAPHYLOCOCCAL INFECTIONS BY STANNOXYL —"MIXED INFECTION" OF PULMONARY TUBERCULOSIS.

By Captain ARTHUR COMPTON.
Royal Army Medical Corps.

In a previous communication [1] I gave an account of the first cases in this country of *furunculosis* and *acne* treated by the new drug stannoxyl, recently put forward by Frouin and Gregoire [2] as a specific for staphylococcal infections. So far the employment of stannoxyl with successful results in staphylococcal infections has been recorded only for *furunculosis* (Frouin and Gregoire [2], Hudelo [3], Compton [1]), *acne* (Frouin [4], Compton [1]), *chronic suppuration of bone* (Gregoire and Frouin [5]), *traumatic osteomyelitis* (Phocas [6]), *suppuration in gunshot wounds* (Phocas [6]).

In view of the fact that the staphylococcus is more or less constantly met with in the microbial flora constituting the "*mixed infection*" *of pulmonary tuberculosis*, it has occurred to me to test the influence of stannoxyl on this condition.

The present paper deals with three clinically definite cases of phthisis so treated, the stannoxyl for the investigation being kindly placed at my disposition by M. Frouin.

Case 1.—Pte. L., aged 23, half-caste Australian aboriginal. Sent back from France February 17, 1917, suffering from *pleurisy*, left side affected. Admitted to hospital at Norwich, where he stayed five weeks; from which he was sent to Dartford where he remained eight weeks. Arrived eventually at Weymouth in May, 1917, feeling pretty well. Next comes a history of three or four days' pain in chest on right side, cough with frothy expectoration (no blood), and a difficulty in keeping his food down. Re-admitted to hospital May 29, with the provisional diagnosis of tuberculosis. *Broncho-pneumonia*. Moist sounds scattered throughout the chest, with harsh breathing at both apices. Following admission, temperature was 100°-101° F., evening temperature 102°-103° F.; pulse 100-140 per minute; respiration 32-40 per minute. Tepid sponging was practised throughout June to control the temperature. First seen by about July 10; when, with the idea of clearing up the "mixed infection"—on the assumption that the case was tubercular, which it was clinically—and thereby bringing down the temperature, stannoxyl treatment was begun. Frequent examinations of sputum for tubercle bacillus were carried out over the period May 30 to August 16, but tubercle bacilli were never found; the pneumococcus was constantly found. The bacteriological findings in regard to a specimen of sputum of July 2 examined by culture on serum-agar for the presence of staphylococci were as follows: No staphylococci isolated; but colonies of three sorts of Gram-negative bacilli, one being Friedländer's; also a Gram-negative diplococcus. Another specimen of

sputum was examined from this point of view on August 7, when *Staphylococcus albus* was found to be present.

Chart 1 indicates the progress of the case from the time stannoxyl treatment began, or just a little previous to this, until the temperature became normal and remained thereafter in or about the normal level. The dotted portion of the chart between July 30 and August 3 corresponds to a missing temperature chart unfortunately lost during a change of hospital.

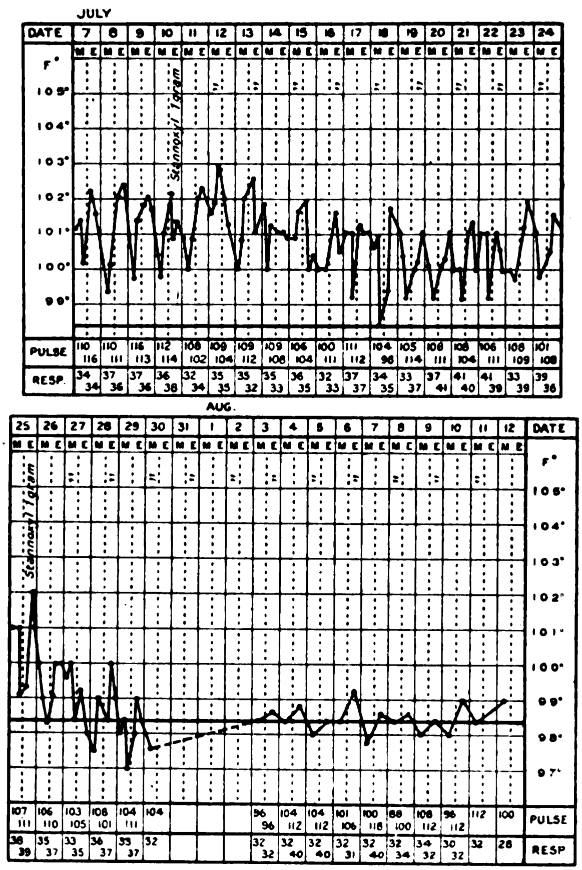


CHART 1.

Only four stannoxyl tablets (about one gramme) were taken per day at the commencement of treatment, and sometimes even less, as the patient was so ill, and one was uncertain what the effect of the stannoxyl might be. Indeed, on July 19, his condition was so bad that an injection of pituitrin had to be resorted to. Seventeen days after treatment with stannoxyl had begun, the temperature fell sharply to in or about normal, and remained so until his discharge from hospital on September 7 to return to Australia. Although still in a weak condition at the time of his discharge, his temperature, with the exception of evening rises to 100·8° F. recorded on three occasions, had only oscillated half a

degree on either side of the normal all through August, his pulse-rate had become on the average 94, his respirations 26; the amount of sputum expectorated had greatly diminished; his appetite had become good; and his general condition had altogether improved, the patient being able to get up and move about his ward a few hours daily. Before his departure he was taking regularly eight tablets of stannoxyl per day.

TABLE I.

Date	Films: Stained by—		Culture
	Ziehl	Gram	
6.9.17	T.B. found ..	—	—
10.9.17	,, ..	Gram-positive diplococcus, Gram-negative diplococcus, and Gram-negative diplobacillus	*Staphylococcus aureus*, streptococcus, pneumococcus, meningococcus, *M. tetragenus*
15.9.17	—	—	Streptococcus, pneumococcus, meningococcus, *M. tetragenus*
21.9.17	T.B. found ..	—	Streptococcus, meningococcus, *D. flavus*, Gram-negative coccobacillus
27.9.17	,, ..	Gram-negative diplococcus	*Staphylococcus aureus*, pneumococcus, *D. flavus*, yeast cells
1.10.17	,, ..	Gram-positive diplococcus, Gram-negative diplococcus	Streptococcus, pneumococcus, meningococcus, *D. flavus*
5.10.17	No T.B. found	Streptococcus, Gram-negative diplococcus	*Staphylococcus albus*, pneumococcus, streptococcus, *D. flavus*
7.10.17	T.B. found ..	Gram-negative diplococcus	*Staphylococcus albus*, pneumococcus, *D. flavus*, *B. diphtheroid*, two kinds of Gram-negative bacilli (not identified)
12.10.17	,, ..	Gram-positive diplococcus, Gram-negative diplococcus	*Staphylococcus albus*, streptococcus, pneumococcus, *D. flavus*, a long-curved Gram-negative bacillus (not identified)
19.10.17	No T.B. found	Gram-positive diplococcus, pneumococcus	Streptococcus, pneumococcus, meningococcus, *M. tetragenus*, Gram-negative bacillus (not identified)
25.10.17	T.B. found ..	Pneumococcus	*Staphylococcus albus*, streptococcus, pneumococcus, *D. flavus*, and Gram-negative bacillus (not identified).
31.10.17	No T.B. found	Gram-positive diplococcus	Streptococcus, pneumococcus, *M. tetragenus*, and *D. flavus*
12.11.17	,, ,,	Gram-positive and Gram-negative diplococci	Streptococcus, pneumococcus, *D. flavus*, and *B. Friedländer*

Case 2.—Pte. W., aged 19. Joined the Army in January, 1917. He caught a cold in February during his training in a camp at Ripon, when he had a cough and frequently spat up blood, but he did not report sick to his medical officer. The cough eventually passed off, and he arrived in France in June, 1917. He was wounded at Ypres on August 15 by a bullet in the left forearm, which necessitated amputation of the arm. He was sent to Boulogne, where he remained in hospital a few days, and was eventually transferred to Weymouth, arriving here on August 28. He then had a cough and complained of always sweating (chiefly in the day-time). His physical signs at this time (examination of September 4) were: Right lung, in front, dullness and bronchial breathing at

the apex; behind, crepitations scattered all over the lung. Left lung, in front, breathing good at the apex, dullness and crepitations over lower lobe; behind, dullness especially at the base, bronchial breathing at the level of the spine of the scapula, and coarse crepitations at the base. A specimen of sputum examined on September 6 revealed the presence of tubercle bacillus. Stannoxyl treatment was begun on September 8, 4 tablets (1 gramme) being taken the first day,

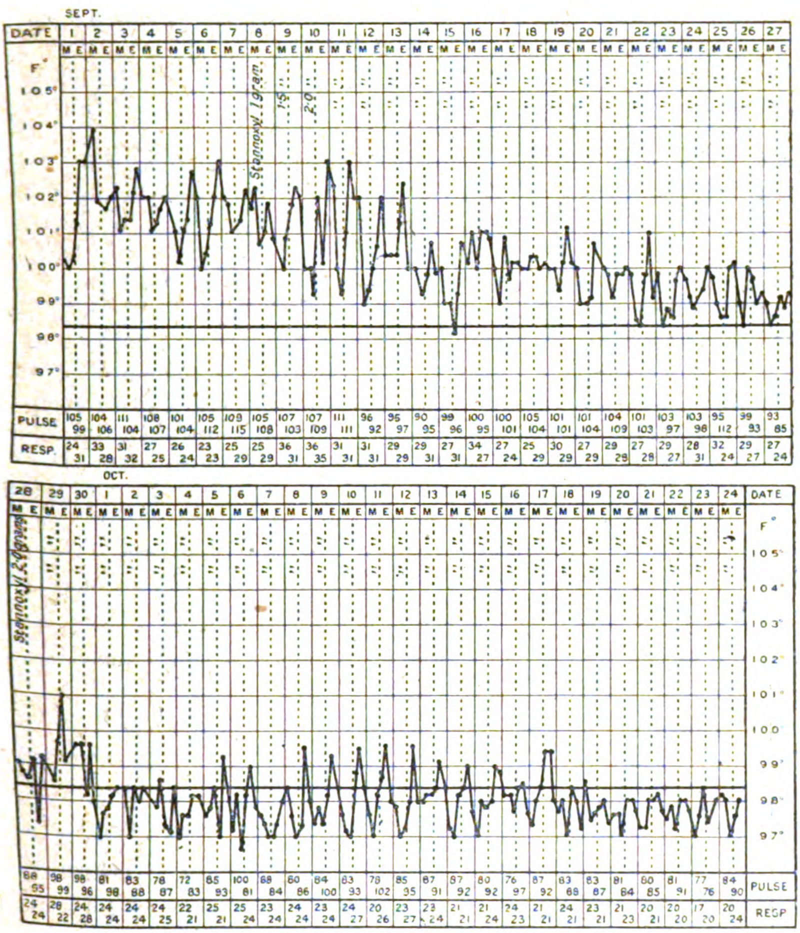


CHART 2.

6 the second, and 8 per day ever since. Chart 2 gives a graphical representation of the progress of the case, showing the response to treatment. Systematic examination of sputa were carried out during the course of treatment, to ascertain the effect *in vivo* of stannoxyl on the microbial flora constituting the "mixed infection." Table I indicates the findings.

During the fourth week of treatment, as Chart 2 indicates, the temperature fell to normal, and after oscillating for a fortnight more or less widely about the

normal, eventually ran a subnormal course for three weeks before settling down about November 7 to oscillate less than half a degree F. on either side of the normal. At the same time the pulse and respiration rates improved, the quantity of sputum became less, the appetite became very good and the patient visibly put on flesh. The physical signs also showed improvement, as the following examination of November 9 shows: Right lung, at the apex, dullness, prolonged expiration but no crepitations in front; behind, dullness, prolonged expiration and some crepitations on deep inspiration; lower lobe, breath sounds not very clear but no crepitations. Left lung, breathing normal.

Since September 29, the patient began to get up, and that no doubt is the explanation of the rise of temperature of that date. Since October 6, he has been going out every day for a short walk.

Case 3.—Pte. D., aged 19. Joined the Army in November, 1916. Admitted to hospital on August 30, 1917, complaining of "tightness in the chest and cough." For the few days following admission, his morning temperature was 100°-101° F., and that of the evening 102°-103° F.; pulse-rate 88-110, and respiration rate 22-24. Physical examination on September 7 revealed marked dullness at the right base, diminished fremitus and vocal sounds, with deficient air entry. A sputum examination of September 9 showed the presence of a few tubercle bacilli; while this was confirmed in a second specimen of September 13, in which more bacilli were found. On September 24 there was marked dullness in the right axillary space extending from the fifth to the eighth ribs, vocal and tactile fremitus were diminished, and the breath sounds were distant; the patient had profuse night-sweats. Stannoxyl treatment, as indicated on Chart 3, was begun on October 2; and throughout the treatment numerous bacteriological examinations of the patient's sputum were carried out to ascertain the effect of the treatment on the flora constituting his "mixed infection." Table II indicates the findings.

TABLE II.

Date	Films: Stained by—		Culture
	Ziehl	Gram	
9.9.17	T.B. found ..	—	—
13.9.17	,, ..	—	—
6.10.17	,, ..	Pneumococcus, Gram-negative and Gram-positive diplococci	*Staphylococcus albus*, streptococcus, pneumococcus, *B. proteus*, *B. diphtheroid*, Gram-negative coccobacillus
7.10.17	,, ..	Pneumococcus, Gram-positive diplococcus	*Staphylococcus albus*, streptococcus, pneumococcus, a Gram-negative bacillus producing a pink-brown pigment
10.10.17	,, ..	Pneumococcus, Gram-negative diplococcus, Gram-negative coccobacillus	—
18.10.17	No T.B. found	—	Pneumococcus, *B. diphtheroid* and Gram-negative bacillus producing a pink-brown pigment
26.10.17	,, ,,	Pneumococcus, Gram-positive diplococcus	*Staphylococcus albus*, streptococcus, pneumococcus, *M. tetragenus*, and Gram-negative bacillus producin a pink-brown pigment

Two weeks after his having been put on stannoxyl, we find the temperature reduced to normal, or rather subnormal, in which region it remained more or less until his discharge from hospital on October 30. He was discharged on this date to proceed to a sanatorium, since when he has been lost to view. In addition to the patient's temperature becoming normal under the influence of the treatment, his general condition showed almost daily improvement. His night-sweats disappeared, his sputum became markedly less, his pulse and respiration rates became more nearly normal, and he was rapidly putting on flesh—having gained eight pounds, as indicated on Chart 3, between October 11 and 25. He had been getting up ten days, and had been taking walks outside for five days, previous to his discharge from hospital.

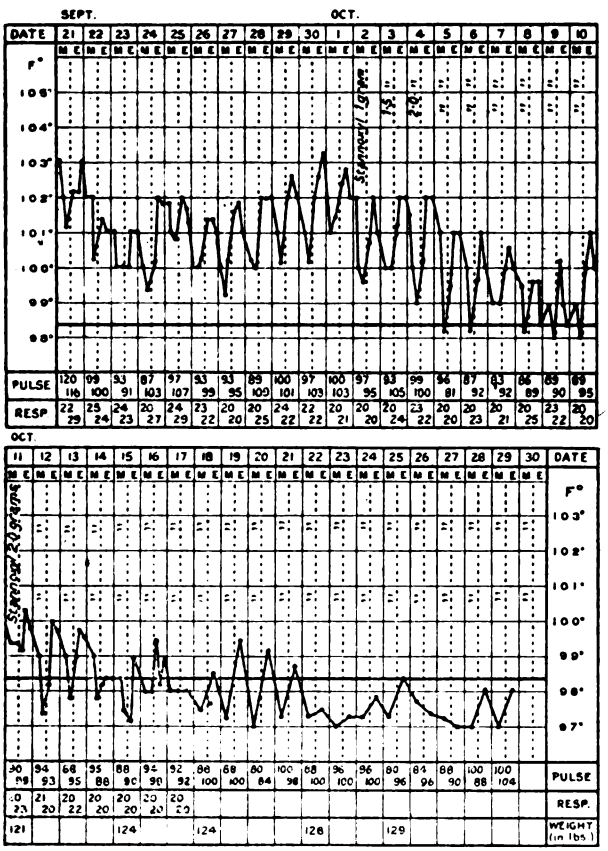


CHART 3.

These three cases: one of *broncho-pneumonia* (? tubercular), and the other two of *pulmonary tuberculosis*, are of particular interest. As cases they constitute a record of the first attempt, so far as I am aware, to combat by means of stannoxyl the "mixed infection" of *pulmonary tuberculosis*—infection long recognized as the agent responsible for the temperature, and which really kills and carries off the patient in *phthisis*.

In all three cases, under the influence of stannoxyl treatment the temperature sooner or later fell to the region of normal: in three weeks for the first, in four weeks for the second, and in two weeks for the third. At the same time, a corresponding improvement occurred in the general condition; the pulse and respiration rates became more nearly normal, the sputum expectorated steadily became less, the appetite improved, and the patients put on flesh.

Considering, therefore, the results achieved in the above three, of five, cases which I had at my disposition for the investigation, the publication of their notes to-day seems justifiable. The other two cases, in a dying condition when first seen by me and put on stannoxyl, did not survive long enough to permit of the drug having a fair trial, their disease carrying them off within a week of commencement of treatment. Case 1 has for the time being been lost sight of, owing to his discharge from the Army and return to Australia; as also Case 3, having been discharged to a sanatorium. Case 2 is still under observation and treatment.

These therapeutic studies, and those already published on *furunculosis* [1], constitute a complete confirmation of Frouin and Gregoire's original *in vitro* observations [2]. The more the conditions of culture in the body are anaerobic, the more the stannoxyl would appear to act by rendering the soil unfit for staphylococci to live and survive in. That is the condition met with more particularly in *furunculosis*. On the other hand, in the "mixed infection" of pulmonary tuberculosis the condition of life for the staphylococci, and associated microbes, approach more and more aerobic conditions. At any rate, that would afford any explanation of the bacteriological findings recorded in Tables I and II, where although quantitative diminution in the amouut of sputum occurred under the treatment, yet qualitatively the "mixed infection" remained more or less constant throughout. This is suggestive that the curative action of the stannoxyl may have been in attenuating the virulence of the microbes present.

How stannoxyl in the soil may bring about the attenuation of virulence is unknown; but an observation of Frouin's [4], as bearing on the question is of much interest. When metallic tin is incorporated in a nutritive medium containing alcohol, which is then inoculated with *mycoderma aceta*, the production of acetic acid in the medium is diminished, or totally hindered, although the growth of the microbe is not interfered with. That points to the attenuation of virulence being possibly due to some reaction akin to that which electrolytes play generally in activating and inactivating enzymic activities [7]. The question is both an interesting and important one, opening up as it does new vistas of research.

I wish to express my thanks to Lieutenant-Colonel E. Carrol, I.M.S., Captain K. B. Clarke, R.A.M.C. (T.), Dr. S. Penny Snook and Dr. James Miller for kindly placing the above patients at my disposal for the purpose of this investigation.

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NOTE ON THE CONNEXION BETWEEN CHEMICAL COMPOSITION AND THE PHENOL COEFFICIENT OF LIQUOR CRESOLI.

By Lieutenant GUY T. P TATHAM.
Royal Army Medical Corps (T.).
(*From the Hygiene Department, Royal Army Medical College.*)

Liquor cresoli is prepared from: (*a*) High-boiling tar acids; (*b*) creosote oil; (*c*) castor oil soft soap; (*d*) alkali. Of these the "high-boiling tar acids" represent the acid fraction obtained from blast furnace oil, and include: (*a*) phenols; (*b*) impurities, mainly hydrocarbons. The creosote oil contains a high percentage of hydrocarbons, together with a relatively small percentage of phenols.

The author recently had occasion to examine a number of samples of liquor cresoli with regard both to germicidal power and chemical composition. It appears that the phenol coefficient of a given sample is connected with its percentage hydrocarbon and phenol contents by a planar formula; in other words, the germicidal power is additive, being the sum of the germicidal values of the hydrocarbons and phenols contained in the sample. It is, of course, recognized that hydrocarbons have a distinct germicidal power which, for a particular micro-organism, is no doubt, characteristic of the chemical substance. On the assumption that the germicidal property is additive, it follows that a mixture of hydrocarbons of constant composition (e.g., a standard trade product) also should have a characteristic germicidal power. The same remark applies to a mixture of phenols.

Furthermore, a mixture of the two constituents, hydrocarbons and phenols, should have a germicidal power which is the sum of the germicidal powers contributed separately by the constituents. In other words, the phenol coefficient of a disinfectant should be calculable from its chemical analysis by a formula of the type:—

$$ax + by = P.$$

where x = percentage content of hydrocarbons
y = ,, ,, ,, phenols
P = phenol coefficient

and a and b are constants characteristic of the hydrocarbons and phenols respectively, i.e.—

a = characteristic coefficient of the hydrocarbons
b = ,, ,, ,, phenols.

Consideration of the analyses and phenol coefficients (determined by the Rideal-Walker method) of a number of samples of liquor cresoli gave for the constants a and b:—

$$a = 0{\cdot}075$$
$$b = 0{\cdot}25$$

so that the above formula becomes

$$0{\cdot}075\,x + 0{\cdot}25\,y = P$$

The following table shows the agreement between the phenol coefficient, as determined directly, and as calculated by the above formula from the chemical analysis of samples of liquor cresoli:—

Reference No. of sample	Analysis, percentage by weight	Phenol coefficient (Rideal-Walker method)		
		Calculated from analysis	Determined by test	Difference determined, minus calculated value
2	Hydrocarbons, 60 per cent .. Phenols, 19·6 per cent	9·4	9	− 0·4
4	Hydrocarbons, 47 per cent .. Phenols, 29 per cent	10·8	11	+ 0·2
9	Hydrocarbons, 47·7 per cent .. Phenols, 27·8 per cent	10·5	10	− 0·5
13	Hydrocarbons, 53·1 per cent .. Phenols, 22·1 per cent	9·5	10	+ 0·5
17	Hydrocarbons, 51·4 per cent .. Phenols, 23 per cent	9·6	10	+ 0·4
20	Hydrocarbons, 40·2 per cent .. Phenols, 37·5 per cent	12·4	12	− 0·4

It will be observed that the general agreement between the observed value of the phenol coefficient, and that calculated from the figures of analysis is good.

The applicability of the above formula suggests the following as tentative conclusions, which it is proposed to test by further observations:—

(*a*) Weight for weight the germicidal value of the phenols is greater than that of the hydrocarbons in the ratio of 10 : 3.

(*b*) Owing to the relatively high percentage content of hydrocarbons, the latter contribute appreciably to the germicidal value of liquor cresoli. In illustration of this point, consider samples No. 2 and No. 20 above. No. 2 is high in hydrocarbons and low in phenol content. The hydrocarbons contribute forty-eight per cent of the germicidal value and the phenols fifty-two per cent. In the case of No. 20, which is relatively low in hydrocarbons and high in phenol content, the hydrocarbons contribute twenty-four per cent of the germicidal value, while seventy-six per cent is due to phenols.

(*c*) Given the analyses of the "high-boiling tar acids" and of the creosote oil to be employed in the manufacture of liquor cresoli, it should be practicable to calculate from the percentages of these ingredients used the phenol coefficient of the resulting disinfectant; or, vice-versa, required a disinfectant of specific phenol coefficient to calculate the percentages in which the respective ingredients should be employed.

ANALYSIS OF ONE HUNDRED CONSECUTIVE CASES OF REPUTED "ENTERICA" ADMITTED TO CHOUBRA HOSPITAL, CAIRO, FOR THE MOST PART DURING THE MONTHS OF JUNE AND JULY, 1916.

By Captain BAHR.
Royal Army Medical Corps.

Assisted by Captain GARROW.
Royal Army Medical Corps.

In view of the difficulty of diagnosis of cases of "enterica" reported on Army Form, the following inquiry has been instituted in cases admitted to and remaining under observation at Choubra Military Infectious Hospital, Cairo.

One of us has had the advantage of working for two years in the London Fever Hospital, and has also had a year's experience of "enterica" at the Military Infectious Hospital, Imtarfa, Malta, while the other has been able to follow the cases under consideration in the wards of this hospital, and at the same time has carried out all the necessary bacteriological investigations.

It only remains to be stated that the critical analysis of enterica cases given below has been undertaken for statistical purposes, and has been arrived at both by interrogation and physical examination of patients as well as by investigation of the case sheets and temperature charts by two independent observers; and in most cases in consultation with the medical officer in charge of each case.

Choubra Hospital is an infectious diseases hospital of 372 beds which receives cases of "enterica" and dysentery from all parts of Egypt, especially from the various zones of military activity, the Canal Zone, Delta District, and Western Frontier, and occasionally Mesopotamia; therefore the collection of cases admitted to this hospital may be regarded as some indication of the general conditions as to the proportion of true enterica to other similar febrile maladies prevailing in these parts.

It may be stated that amongst the series under consideration there has only been a single death, and he was the only individual case who could be considered as seriously ill on admission, and who died from tubercular meningitis. These cases on analysis fall naturally into five classes, which we now propose accurately to define.

Class 1.—Cases in which the diagnosis has been rendered absolute by the recovery of the organisms from the blood, fæces or urine. It is interesting to note how in every one of these cases the complete symptom-complex has been developed. This class of case we propose to call "*Undoubted enterica.*"

Class 2.—Cases in which the symptom-complex is present, that is to say, a pyrexia of a continued remittent type falling by lysis, accompanied by rose spots and a palpable spleen. In none of these cases has the causative organism been recovered, but the diagnosis has been confirmed by well-marked agglutination tests in which due allowance has been made for inoculation on a definite scheme; that is a titre of 1 : 640 or upwards. This class of case we propose to call "*Probable enterica.*"

Class 3.—Cases in which there exists a reasonable amount of doubt for diagnosis. In these cases there has been a primary febrile illness of some sort with an atypical

fever lasting a week or more, and in which no definite information can be obtained by bacteriological or serological investigation and in which the enlargement of the spleen and the presence of rose spots have not been mentioned or have not attracted attention.

Most of the cases in this class have recently been inoculated with T.A.B. vaccine, and therefore agglutination tests have not been of the same value as an aid to diagnosis. This class of case we propose to call "*Doubtful enterica.*"

Class 4.—Cases of pyrexia of short duration in which there are no clinical or serological grounds on which to base a diagnosis; the majority of these are convalescent on admission. This class of case we propose to call "*Probably not enterica.*"

Class 5.—Cases which have been definitely proved, either by observation of symptoms, microscopical examination of the blood, or bacteriological examination to be examples of other diseases. This class we propose to call "*Not enterica.*"

We now propose to give the statistics in detail:—

Class 1 Undoubted *enterica* 27 per cent		Class 2 Probable *enterica* 28 per cent	Class 3 Doubtful *enterica* 13 per cent	Class 4 Probably not *enterica* 26 per cent	Class 5 *Not enterica* 6 per cent	
Typhosus	2				Undulant fever ..	1
1 Blood culture					Tubercular meningitis	1
1 Urine					Tertian malaria ..	1
A.	10				Phlebotomus fever ..	1
7 Blood culture					Acute rheumatism with endocarditis ..	1
1 Fæces					Otitis media, septic absorption 1 mastoiditis ..	1
1 Urine						
B.	15					
8 Blood culture						
6 Fæces						
1 Urine						

In conclusion, we do not consider that the statistical figures given above require amplifying in any way, but that we have some grounds for stating that in our opinion in fifty-five per cent (Classes 1 and 2) only of cases primarily admitted as "enterica" to this hospital does the diagnosis rest on scientifically adequate evidence.

Bacteriological Results. By Captain Bahr, R.A.M.C.

As further proof of the comparatively small amount of true enterica I append statistics of the results of examination for enterica organisms of the bacteriological material submitted to the laboratory of Choubra Hospital during the months of March to July, 1916:—

(1) Blood Cultures: 5 c.c. of Blood in 20 c.c. of Bile.

Month	Number examined	*Enterica* organisms isolated	Percentage
March	17	2	11·7 per cent
April	76	2	2·7 ,,
May	75	7	9·3 ,,
June	73	10	13·6 ,,
July	13	0	7·6 ,,
Total	254	22	8·6 per cent

Proportion of Various Enterica Organisms isolated.

T.	A.	B.
6	9	7

(2) Urines.

Month		Number examined		*Enterica* organisms isolated		Percentage
March	..	74	..	0	..	0·0 per cent
April ..	..	206	..	0	..	0·0 ,,
May ..	..	147	..	3	..	0·2 ,,
June ..	..	219	..	1	..	0·4 ,,
July ..	..	173	..	1	..	0·5 ,,
Total	..	819	..	5	..	0·5 per cent

Proportion of Enterica Organisms isolated.

T.	A.	B.
1	3	1

(3) Fæces.

Month		Number examined		*Enterica* organisms isolated		Percentage
March	..	70	..	1	..	1·3 per cent
April ..	..	213	..	0	..	0·0 ,,
May ..	..	175	..	0	..	0·0 ,,
June ..	..	201	..	3	..	1·4 ,,
July ..	..	172	..	1	..	0·6 ,,
Total	..	821	..	5	..	0·5 per cent

Proportion of Enterica Organisms isolated.

T.	A.	B.
0	3	2

NOTE ON THE EPIDEMIOLOGY OF AMŒBIC DYSENTERY.

By H. M. WOODCOCK, D.Sc.

Protozoologist to the Force in Egypt.

(*From the Military Laboratory, Jaffa.*)

Wenyon and O'Conner, while in Egypt, demonstrated[1] that amœbic cysts (including those of *Entamœba histolytica*) can pass successfully through the alimentary canal of house-flies, to be voided in the fæces, wherever these may be deposited: and they also found the cysts in the intestines of caught "wild" flies. As a result of their experiments, these workers concluded—somewhat hastily perhaps—that house-flies are a very potent factor in the spread of amœbic dysentery. Since then, there has been a general disposition to regard the fly as the chief agent by which this infection is spread.

During the past two years I have had the opportunity of studying the incidence of amœbic dysentery in various parts of Egypt, and before I had been long at work I formed the opinion that far too much stress had been laid upon the part actually

[1] In a Memorandum published in Egypt, 1916, and reprinted later in the Journal of the Royal Army Medical Corps, May, 1917.

played by flies in the transmission of this disease. Some factor other than flies is essential—a factor, moreover, which does not appear to be of nearly so much importance in the spread of bacillary dysentery.

In the Southern Canal area, where I was stationed for over a year, flies were abundant, especially during autumn and spring. Amongst British troops bacillary dysentery was very common, whereas the amœbic type was rare. Details of the various infections were given in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS for September, 1917, so that it must suffice to state here that about 75 per cent of the total stools examined were bacillary dysenterics. Barely 2 per cent on the other hand were amœbic. Among Indian troops, it is interesting to note, amœbic dysentery prevailed to a considerably greater extent, 12½ per cent of the dysenterics showing active *E. histolytica*, while this parasite was found, in one phase or another, in over 15 per cent of the total stools examined. Nevertheless, there was, I consider, little or no *increase* in the number of infected men, i.e., no appreciable spread of the infection in this area, because the percentage of cases of amœbic dysentery was distinctly less than the percentage of Indians (about twenty per cent) who were found to be carrying normally the cysts of *E. histolytica*, and the great majority of these men had come direct from India to Egypt. That is to say, amœbic dysentery among the Indians occurred mainly, at any rate, in men who were already carriers; the hardships and stress of active service in the field had tended, in a number of these men, to lower the vitality and impair the resistance of the bowel, and as a consequence an attack of amœbic dysentery resulted.

Now, if flies are the principal factor in the transmission of amœbic infections, how is it that while flies were abundant and *bacillary dysentery very common* amongst the British troops, amœbic dysentery (and, incidentally, all intestinal protozoan infections) were nevertheless rare? It cannot be maintained that the sanitation (using the term comprehensively to include fly prevention) was so perfect that the cysts had no opportunities for dissemination, because there is the fact that bacillary dysentery—which is, most probably, in the main fly-borne—was prevalent. It is evident that, whether the fly is or is not an important vehicle of transmission in the case of amœbic dysentery, some essential factor was lacking. This factor is water—moisture and humidity—which in my opinion is more important than any number of flies; and latterly there has been too great a tendency to overlook this essential factor in the transmission.

It has long been known that amœbic cysts cannot withstand drying. On the other hand, it was shown by Penfold, Woodcock and Drew (*British Medical Journal*, 1916, 1, p. 714) that the cysts of *E. histolytica* can retain their vitality—proved by their ability to excyst—in water for at least a fortnight and probably for a longer period. And the significance of these two opposing biological points, in their bearings on the successful propagation of the species, has not hitherto been sufficiently recognized. A fly very rarely (unless accidentally) alights on a liquid surface; its minute droplet of fæces is practically always deposited on a dry surface. Hence in hot countries, such as those in which amœbic dysentery is common, the fæcal droplet dries up in an instant or two. The chances of the survival of the cysts and successful infection of a new host by this method of contamination are therefore extremely slight. Now, under what climatic conditions is amœbic dysentery found to be most prevalent? Under conditions such as those

obtaining in India and Mesopotamia, for example, especially in areas which possess during certain seasons of the year a very damp climate with a high degree of humidity. In such lands there is an excellent chance for the survival of the cysts deposited in human fæces and for their successful dissemination by the agency of water in various ways.

In this connexion Egypt occupies a particularly interesting position. Over a large area (including the Southern Canal Zone) this is a very hot and dry land, with scarcely any rain and a low degree of humidity. An exception is provided by the coastal fringe bordering the Mediterranean, where the humidity is much greater owing to the moisture-laden northerly winds. Hence, on the above view, one might expect to find a higher percentage of amœbic infections in this northern district than in that in which I was at first working, and I soon had indication that this was the case. While at Suez I found that the percentage of carriers amongst the native population was only four to five per cent, considerably less than that noted by Wenyon and O'Connor, working in Alexandria (about twelve per cent). But, on the other hand, it may be mentioned, amongst E. L. C. men and Turkish prisoners of war, *coming from Mesopotamia* and examined while in the quarantime camps near Suez, nearly twelve per cent. were infected with *histolytica.* Conversely, out of over fifty prisoners from the Hedjaz (Arabia) I did not find a single carrier.

In the summer of 1917 I was transferred to Kantara and dealt there entirely with cases of dysentery, etc., occurring amongst troops east of the Canal, in the northern coastal district alluded to. And I soon found, as expected, that there was a distinctly higher incidence of amœbic infections amongst the British troops than I had met with in the southern Canal area. For the corresponding season (April to October),[1] the percentage of amœbic dysenteries (i.e., showing active histolytica) was 7 per cent of the total dysenterics, as against $2\frac{1}{2}$ per cent; and the percentage of histolytica findings (all forms) in the total stools examined (over 2,100) was 5·2 per cent compared with slightly under 2 per cent. On the other hand, the percentage of definite bacillary dysenterics to the total stools was much less than at Suez, viz., 37 per cent compared with 75 per cent, the fly campaign being probably more vigorous and effective.

Thinking it might prove instructive to compare the variation in the amœbic findings with the variation in the relative humidity, I requested the Physical Department of the Public Health Bureau, Cairo, to let me have, if possible, tables showing the relative humidity of Suez and Port Said (the nearest station available in the northern district) for the corresponding season in the two years 1916 and 1917, respectively. This information was very courteously afforded me and I find that while the average mean relative humidity of Suez for the months March to October, inclusive, 1916 was only 48 per cent, that of Port Said for the same period, 1917, was 75 per cent. I have constructed the accompanying chart, comparing the mean relative humidity at Port Said with the incidence of amœbic infections, in monthly periods, during the season 1917, and an

[1] For the amœbic findings of the months April to July, I have the kind permission of Captain Stuart, O.C. of the laboratory, to use the laboratory records, as I myself did not take up this work there until August. The findings up to then were made by Captain O'Connor and Captain Stuart.

interesting general correlation between the curves is shown. Curve A indicated by a broken line gives the actual number of amœbic dysenterics with active *E. histolytica;* curve B (a dotted line) shows the percentage of the total findings of histolytica (active forms or cysts) to the number of stools examined, while curve C (continuous line) indicates the relative humidity. (The amœbic curves begin in April, as that was the first complete month the laboratory was open.)

Two or three points brought out by these curves may be noted: (1) Following upon the low relative humidity for April, a dry month, probably on account of Khamseen winds, there is a distinct drop in the amœbic infections for May, the fall being more pronounced in the curve representing the total percentage of findings; (2) on the other hand, the month with the highest relative humidity (August) is also that in which both the amœbic curves reach their highest level, and the rise has been greatest in the acute cases. The reason for this slight divergence is probably that the *degree* of infection in the first instance is less in the early months, and so a longer time is required for it to gain a hold and become readily apparent; (3) there is a slight drop in the amœbic curves for July which has no counterpart in the relative humidity curve.

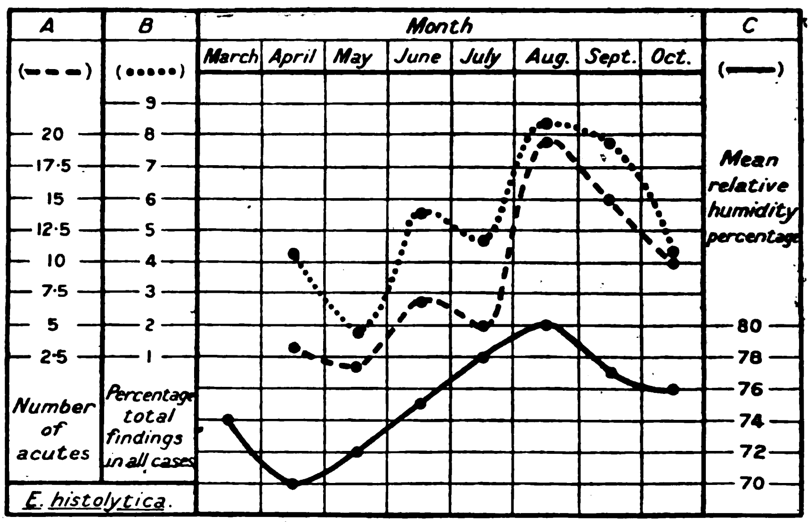

Chart showing Comparison between Amœbic Findings and Relative Humidity, Season 1917.

Now, an important fact is that while after August the amœbic curves fell steadily along with the relative humidity curve, the bacillary dysenterics *rose to their maximum* for the season in October, both as regards actual number (264, compared with a monthly average of 123) and in the percentage of total stools—this being over 56 per cent as against an average of 37 per cent. And it was specially noticed that flies were most numerous during September and the beginning of October.

It is clear, I think, that for amœbic dysentery (and equally for other intestinal protozoan infections) to be prevalent in a particular area, the first necessity is

plenty of moisture and a high degree of humidity. There can be little doubt that water is the principal vehicle of transmission, infection resulting by such means as drinking contaminated water, eating uncooked, moist food (fruit, "greens," etc.), which has been fouled. In districts where amœbic dysentery is known to be common, the elimination of carriers amongst men who are cooks, or in any way concerned in the preparation or distribution of food and drink, should be aimed at, in order to reduce the liability to infection of troops. There is little indication that flies themselves play any important part in the spread of amœbic or other intestinal protozoan infections, but considerable evidence that they are a main factor in the spread of the bacillary type of dysentery.

It would be useful to have data corresponding to those which I have given above, from workers in the military laboratory in Mesopotamia. Owing to the intense relative humidity of that country during certain seasons, one would expect to find a distinctly higher percentage of amœbic infections amongst the British troops there than has been met with in any part of Egypt.

Report.

STATISTICAL REPORT OF THE OPHTHALMIC WORK CARRIED OUT AT THE 2ND LONDON GENERAL HOSPITAL, ST. MARK'S COLLEGE, CHELSEA, S.W., FROM SEPTEMBER, 1914, TO THE END OF THE YEAR 1917.

By Major W. ORMOND.
Royal Army Medical Corps.

Summary.

Category		Total
Out-patients		5,896
Men Blinded in the War		684
Enucleations of One Eye		436
Affections of the Cornea :—		
Corneal Ulcer	205	
Interstitial Keratitis	36	
Corneal Opacities	35	
	—	276
Cataracts		130
Affections of the Conjunctiva :—		
Conjunctivitis	128	
Trachoma	39	
Blepharitis	33	
	—	200
Affections due to Indirect Injury :—		
Concussion Injuries	117	
Concussion Blindness	39	
Contusion Injuries	110	
	—	266
Affections due to Direct Injury :—		
Foreign Bodies in Globe and Orbit	116	
Perforating Wounds of Globe	31	
Injury to Orbit involving Acc. Sinuses	16	
	—	163

Category		Total
Affections of the Uvea :—		
Iritis	96	
Choroiditis	47	
Cyclitis	34	
	—	177
Affections of Optic Nerve and Retina :—		
Optic Nerve, Atrophy	47	
Detachment of Retina	15	
	—	62
Myopia, etc. :—		
Myopia	54	
High Degree of Astigmatism	5	
	—	59
Vitreous Opacities, Intraocular Hæmorrhage		109
Nystagmus		15
Lachrymal Obstruction		14
Strabismus		13
Injuries to Nerves		9
Glaucoma		4
Episcleritis		5
Neurasthenia		9
Affections due to Various Causes :—		
Periostitis of Orbital Walls, Sinuses, etc.	3	
Syphilis : 1 Primary Chancre, 1 Tertiary	2	
Congenital Dislocation of Lenses	1	
Exophthalmic Goitre	1	
Burns	1	
Injury to Occipital Lobe	2	
Hemiplegia	1	
	—	11
Plastic Operation		64
Unclassified (Papers not available)		68

Out-patients	5,896	
In-patients	2,774	
	8,670	

Category	Average time in hospital per patient Days
Enucleation of one eye	39
Corneal ulcer	36
Interstitial keratitis	41
Corneal opacities	30
Cataracts	43
Conjunctivitis	29
Trachoma	27
Blepharitis	25
Concussion injuries	38
,, blindness	31
Contusion injury	31
Foreign body in eye and orbit ..	40
Perforating wound	32
Injury to orbit	57

Category	Average time in hospital per patient Days
Iritis	35
Choroiditis	40
Cyclitis	45
Optic atrophy	33
Detachment of retina	36
Myopia	20
Vitreous opacities, etc.	39
Nystagmus	18
Lachrymal obstruction	33
Strabismus	25
Nerve injury	37
Glaucoma, etc.	27
Plastic operation	59

Taking the total number of in-patients, for whom we had definite notes, irrespective of their different categories, the average length of stay in hospital for each man was thirty-five days.

Out-Patients.

The number of new cases seen in the out-patient department between October, 1914, when this department was first started, up to the end of 1917, was 5,896. This does not include second and subsequent attendances.

The out-patient department has been used extensively by medical officers attached to camps, hospitals, labour centres, recruiting boards and travelling medical boards in and around London. Men have attended from Epping Forest, Hertford, Mile End, Bethnal Green, Tooting, Mitcham, Springfield, Hampstead, Fulham, Dollis Hill, Richmond; from the large camps at Wimbledon and the White City; from the various Labour Centres in London, and from the Guards' Depots at Purfleet, Windsor and Reading.

Many other centres, also, too numerous to mention, have asked and received opinions on ophthalmic conditions occurring in soldiers under their command.

Owing to the fact that as early as 1914 the 2nd London General Hospital was constituted an Ophthalmic Centre where the men blinded in the War were to be sent, the hospital at Chelsea was referred to by large numbers of units, command depots, hospitals, etc., for specialists' opinions on ophthalmic matters.

The numbers for each year have shown a very marked increase on the preceding year, and the numbers in 1918 are likely to be nearly equal to the preceding two years taken together.

The work of the department consists largely of testing the eyesight of men, and recording their vision, working out their errors of refraction, ordering glasses if advisable, writing out reports for the medical officers sending the cases, fitting artificial glass eyes, treating small surgical or medical ailments, making ophthalmoscopic examinations and, in 1917, discouraging malingerers.

In addition the 2nd London General Hospital is a spectacle centre for the distribution of glasses ordered elsewhere, but no account of such work appears in this report.

Number of New Cases seen as Out-Patients from October 7 to December 31, 1917.

Hypermetropia and hypermetropic astigmatism	1,356
Myopia and myopic astigmatism	1,814
Mixed astigmatism	287
Presbyopia	115
Amblyopia in one eye	274
Strabismus	133
Enucleation	99
Nystagmus	31
Vitreous opacities	41
Retinal affections	56
Cataracts	122
Conjunctivitis, lids and lachrymal affections	241
Foreign bodies on cornea, injuries, &c.	101
Corneal ulcer, opacities, &c.	229
Cyclitis	5
Iritis	43
Optic nerve affections	27
Choroidal affections	76
Gas cases	18
Inspections, opinions, records of visions, etc., where no treatment or spectacles were considered advisable from a military standpoint	328
	5,896

Men Blinded in the War.

Of the men who have been blinded during the War, I have notes of 684, seen during the years 1914-1917 inclusive.

Generally speaking they may roughly be divided into two main classes:—

(1) Those who lost their sight owing to a transversely passing missile, a bullet or piece of shrapnel, which entering on one side of the head passed horizontally or obliquely across and came in contact directly or indirectly with one or both orbits, passing out on the opposite side.

The majority of these wounds were probably due to bullets, which in most cases passed clean across and did not remain in the tissues; sometimes the bullet was removed subsequently, but not in the greater number of cases. Pieces of shrapnel, on the other hand, frequently remained in the tissues owing no doubt to the fact that their irregular shape rendered them less able to overcome the resistance incurred.

(2) Cases in which, owing to the bursting of a shell, bomb, etc., in front of the face, the eyes themselves were either destroyed directly, or pieces of metal penetrating them, they subsequently shrivelled up as the result of a chronic septic iridocyclitis, engendered by the presence within the globe of innumerable minute metallic foreign bodies.

The proportion of bullet wounds, i.e., "through and through" wounds, to those due to shell bursts is about 2 to 3, and the proportion has increased during the last year, that is to say, there are fewer simple straightforward bullet wounds, and more wounds due to bursting shells, etc. The reason for this is probably that given to me by Colonel ——, at the end of 1917, when I pointed out to him that we were receiving very few cases due to sniper's bullets compared with 1915 and 1916: "Ah! we have learnt how to deal with snipers now."

During the first three years of the war 659 men were transferred from the 2nd London General Hospital to St. Dunstan's Hostel. All these cases were wounded or lost their vision in 1914-1917, and were for all practical purposes blind. Of these, 340 were actually and really blind—that is they had no sight at all; 175 of these had no eyes, both having been either destroyed by the injury or removed subsequently on account of panophthalmitis, pain, etc.; the remainder had either shrunken globes, severed optic nerves or such extensive disorganization of the retina and choroid, etc., as to destroy sight entirely.

The majority of these St. Dunstan's cases were due either to "through and through" bullet wounds, sometimes called "entrance and exit" wounds, or to shell splinters driven against them by explosion.

The recorded numbers are: "Through and through" cases, 140; shrapnel and explosion injuries, etc., 248. In some cases the notes do not specifically state which was the cause.

A small number of blind cases, about seventeen, are the results of disease, such as optic atrophy, Leber's atrophy, detached retina, etc.

Amongst the men retaining some sight were one-eyed men with ruptures of the choroid, organized masses of blood in the vitreous, traumatic cataracts and traumatic iridocyclitis with shrunken globes.

Of these the happiest experience was of course that of the men who had traumatic cataracts, who by subsequent needling and evacuation of the lens material, got reading vision with proper glasses. If (and there have been

about a dozen such cases) vision after the removal of the lens gave them 6/18 or better with correction, they were not kept at St. Dunstan's.

In some cases the fields of vision were good; damage having occurred to the macula only, and many men could "see to get about," but not having reading vision they were retained at St. Dunstan's for educational purposes.

Deliberate malingering was very rare indeed; a few men took exaggerated views of their disabilities, and owing to the increased pension for total loss of sight and the attractions of St. Dunstan's, were unduly influenced perhaps to acclaim themselves "blind"; more so than would have been the case had there been no such amenities; they however were not as a rule very persistent.

It is impossible to record in this brief résumé of the hospital work all the many interesting and instructive cases among these men, but those which illustrate some special point of interest will be related in a subsequent paper.

The cause of the loss of vision among all the 684 men under consideration here was either:—

Concussion injury, rupture of choroid and retina, intraocular hæmorrhage, atrophy of ciliary body and shrinking, optic atrophy, sclerosing keratitis, traumatic cataracts, detachment of retina, or injury to occipital lobe, and sometimes two or more of these causes were operating.

Enucleations.

Total number of cases of enucleation			436
Number enucleated in England		76	
,, ,, Abroad		345	
,, no note where enucleated		15	
,, returned to duty		293	
,, sent to auxiliary hospitals		91	
,, discharged as permanently unfit		18	
,, of whose discharge there was no note		32	
,, died		2	
Number died		2	
Meningitis	1		
Peritonitis	1		

In this group are placed cases in which one eye was removed, the other retaining good vision.

The reasons for the enucleations are in their order of numerical importance.

(1) Gross injury at the time of the wound.

(2) The presence of foreign particles in the eye.

(3) Feared sympathetic inflammation.

(4) Persistent pain.

(5) Panophthalmitis.

Amongst the number are two cases removed on account of sarcoma of the ciliary body; two for staphylomata, following corneal ulcer, and two for secondary glaucoma.

Only one case developed sympathetic ophthalmia and he regained 6/9 vision in the sympathizing eye.

The insertion of a glass ball in Tenon's capsule is recorded in twelve cases and these were all successful in giving the patient an excellent stump for the carrying of an artificial glass eye.

Affections of the Cornea.

Total number of cases		276
Corneal ulcer	205	
Corneal opacities	35	
Interstitial keratitis	36	

Total number of cases of corneal ulcer		205
Number due to traumatism	85	
,, ,, non-traumatic causes	100	
,, ,, malaria	8	
,, ,, dendritic ulcers	11	
,, ,, gas	1	
Number returned to duty	127	
,, sent to auxiliary hospitals	61	
,, discharged as permanently unfit	7	
,, of whose discharge there was no note	10	

Men were boarded as permanently unfit when either they were one-eyed men or both eyes were affected.

Corneal Ulcer.

There were 205 cases of corneal ulcer. Of these eighty-five were due to traumatism of some form; the majority the result of bomb explosions by which small fragments of metal, stone, mud or grit were hurled against the eyes. They were all of a superficial variety and resolved under the treatment ordinarily employed for corneal ulcers of a septic traumatic nature; some required actual cauterization either with the electric cautery or with pure carbolic.

This group does not include any in which perforation had taken place; those will be found amongst foreign bodies in the globe; 100 were non-traumatic. These include a large number of simple ulcers due to septic absorption; septic teeth being sometimes a cause. Most were associated with similar conditions experienced during civilian life which recurred during the stress of military life, and were no doubt the results of the hardships and exposure on physiques which were not sufficiently robust to stand the strain.

The dendritic ulcers were an interesting group and their association with malaria was definitely substantiated in some cases, but men coming from Salonica, Mesopotamia and the East, and giving a history of malarial infection, were found to have ulcers which clinically showed no signs of being herpetic in form, and in some cases typical dendritic ulcers were found in men who had no history of malaria and had never been in the East.

The result of the treatment in these cases of corneal ulcer is very satisfactory from a military point of view. Only a very few were permanently discharged the Service, the vast majority being returned to duty or to convalescent homes for continued treatment, and subsequently to duty. Those discharged permanently were cases in which either both eyes were involved, or where one eye had been removed previously.

Interstitial Keratitis.

Total number of cases		36
Number returned to duty	13	
,, sent to auxiliary hospitals	11	
,, discharged as permanently unfit	11	
,, of whose discharge there was no note	1	

The majority of these were straightforward cases of congenital syphilis in men, giving a definite positive Wassermann reaction.

The only point remarkable is that many were older than is usual, as interstitial keratitis is commoner before twenty, and a large proportion of these men were over twenty, and the onset of the keratitis was determined often by a definite wound to the eyes themselves.

Two cases were associated with malaria, one giving a positive Wassermann and one a negative; and two were associated with mustard gas, one giving a positive and one a negative Wassermann.

Corneal Opacities.

Total number of cases		35
Number returned to duty	28	
,, sent to auxiliary hospitals	2	
,, discharged as permanently unfit	5	
Number of cases		35
Traumatic	15	
Non-traumatic	20	

These cases when admitted had healed corneal opacities. The traumatic ones were mainly the result of old accidents in childhood or early youth. A few had occurred as the result of war injuries, healed traumatic corneal ulcers, but the majority were non-traumatic, and the result of superficial keratitis due to ordinary septic causes such as are commonly found in any civilian out-patient department.

Cataracts.

Total number of cases		130
Number due to traumatism	118	
,, non-traumatic in origin	12	
Number of concussion cataracts	19	
Number of cases operated on	41	
Number of cases where final results of vision were recorded—20. Of these 14 obtained vision of 6/24 or better.		
Number of cases not operated on	89	
Of these 12 were non-traumatic and 19 were concussion (partial) cataracts.		
Number returned to duty	53	
,, sent to auxiliary hospitals	35	
,, discharged as permanently unfit	25	
,, of whose discharge there was no note	17	

This category includes 130 cases of cataract affecting one or both eyes in men who still retain sufficient vision in either eye to prevent their being classified as blind men. Of these 130, all are of traumatic origin except 12; 6 of the 12 being lamellar cataracts of the type usually found in children and young adults, and 6 of a senile progressive kind seen in the early stages.

Of the traumatic kind nineteen were concussion cataracts due to contusions of the eye and mostly displaying the star-shaped opacity, located at the posterior pole. Fifty-eight cases of traumatic cataract remained unoperated on, as for one reason

or another surgical interference seemed inadvisable. Forty-one were dealt with surgically and of these twenty have the final results recorded. In twenty-one cases, owing to their being sent to convalescent homes and being boarded from those centres, it has not been possible to obtain the final results, the patients having left the 2nd London General Hospital after being needled but before the pupil was finally cleared of all opacity.

Of the twenty cases in which operative interference has been employed and the results recorded: fourteen have obtained good vision, i.e., 6/24 or better with glasses; six have obtained less than 6/60.

(*To be continued.*)

Review.

THE PHYSIOLOGY OF INDUSTRIAL ORGANIZATION AND THE RE-EMPLOYMENT OF THE DISABLED. By J. Amar. London: Library Press, Ltd. 1918. Price 30s. net.

This costly book is frankly a most disappointing publication. There is undoubtedly, at the present moment, a crying need for a book which will lay down in an authoritative manner the scientific lines to be followed in the re-education of men disabled in the War—a book which will give clearly the basis on which such re-education may be properly founded. Although Professor Amar's book professes to supply this want the very inadequate and sometimes even faulty physiology which makes up a large portion of the book will deter many from accepting even the sounder and more ingenious matter which the volume undoubtedly contains. Professor Amar is an enthusiast and he has done a good deal of useful work, but in the present instance his matter is neither suited for the information of the general public nor for those whose duty it will be to undertake the tuition of our disabled. He has fallen between two stools.

It is to be regretted that Professor Stanley Kent, who had edited the English edition, did not use his blue pencil with more energy and that he did not, in particular, check the translation, which leaves much to be desired, with the original.

The publishers have done their part well, the printing is good and many of the plates really excellent.

E. P. C.

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Original Communications.

A PRELIMINARY REPORT ON AN INVESTIGATION OF THE IMMUNITY REACTIONS IN EGYPTIAN BILHARZIASIS.

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SECTION I.—Introduction; remarks on the cellular-humoral theory of immunity.

SECTION II.—Concerning clinical aspects of Bilharziasis.

SECTION III.—The cellular response following Bilharzial infection:—

(1) Observations on the blood picture in man.

(*a*) The cellular response during the toxæmic stage of Bilharziasis.

(*b*) The cellular response during the stages of localized Bilharziasis.

(i) Blood counts in vesical Bilharziasis (*S. hæmatobium*) made from the sixth to the eighteenth month after infection.

(ii) Blood counts in mixed Bilharzial infections (*S. mansoni* and *S. hæmatobium*) made from the sixth to the eighteenth month after infection.

(2) Observations on the blood picture, etc., in monkeys experimentally infected with Egyptian Bilharziasis.

(*a*) Observations on the blood pictures in monkeys spontaneously recovering from the disease.

(*b*) Observations on the blood picture, etc., in monkeys dying early from the disease.

(*c*) The cellular response observed in the focal Bilharzial lesions of the organs of infected monkeys.

(3) Résumé—

Table I.—Data collected on the immunity response in infected monkeys.

SECTION I.—INTRODUCTION.

THE modern investigation of immunity by such observers as Leishman and Wright has definitely shown the inadequacy of either of the two previous schools of thought on this subject, comprising as they did the "cellular theory" of Metchnikoff, and the humoral doctrine of Nuttall. The body employs *both* the cellular and the humoral lines of defence.

Under the influence of bacterial invasion certain cellular elements of the blood are increased in quantity by the chemiotactic action of a toxin on the bone marrow and hæmopoietic organs, while the humors or fluids are similarly reinforced with immune bodies antagonistic to the invading parasite and its toxin.

The cellular reaction to parasitic invasion appears to follow certain constant lines. Whereas the pyogenic group of bacteria constantly produce a polymorphonuclear neutrophile leucocytosis, helminthic infections are followed by a relative and absolute increase of the eosinophile leucocytes, while in the protozoal diseases, i.e., malarias, leishmaniasis, trypanosomiasis and less commonly recognized relapsing fever and amœbic dysentery, etc., a relative increase of the large mononuclear elements of the blood is apparent.

The humoral reaction is evidenced by the presence of antibodies in the sera of patients suffering from certain bacterial diseases and is quite easily demonstrated. Thus in typhoid fever agglutinin can be demonstrated in the blood by the Widal reaction, and immune body is also found to be present by utilizing the complement fixation reaction of Bordet and Gengou [1], employing as antigen a saline suspension of *Bacillus typhosus*. Similarly in the case of certain protozoal diseases the production of both

agglutinin and immune body has been demonstrated. Thus, Wassermann [2] using as antigen saline extract of syphilitic liver, has shown fixation of the complement with the sera of syphilitic patients, and Noguchi after successfully growing *Treponema pallidum* demonstrated their agglutination in saline suspension when mixed with luetic sera.

Much less is known of the humoral response of the body to invasion by the parasitic metazoa.

In the cystic stage of hydatid disease precipitin and immune body have been demonstrated in the serum of man, who acts as the intermediate host for *Tænia echinococcus*. In 1907 Fleig and Lisbonne [3] demonstrated a specific precipitin in the sera of patients suffering from hydatid disease. Welch and Chapman [4] have confirmed and extended these observations. Guedini [5], Weinberg and Parvu [6], Eckenstein and others, using as antigen hydatid fluid, demonstrated the presence of antibody in the blood of patients suffering from this disease, with a technique similar to the Wassermann reaction.

In the present paper, by means of a specific complement fixation reaction, definite evidence is adduced of an immune body in the sera of patients affected either with the vesical (*Schistosoma hæmatobium*) or the intestinal (*S. mansoni*) type of Egyptian bilharziasis. This is the first record of a specific substance having been isolated from the body of an invertebrate intermediary (Bullinus and Planorbis) infected with a human parasite and which will react with human serum (i.e., that of the definitive host). Investigation of the sera of these patients for an agglutination or a precipitin reaction has yielded negative results up to the time of writing.

The incidence of immune body, as shown by a specific complement fixation reaction, in a disease due to so highly organized a parasite as a trematode worm, is of considerable importance. While there is much analogy between the precipitin and complement fixation reaction obtained from hydatid fluid and similar reactions obtained by the mere introduction of a foreign proteid into an organism, such a reaction in bilharziasis can only be interpreted as a true immunity response. This being the case, it is not unlikely that certain other helminthic infections are similarly accompanied with the formation of immune body, specific for the invading parasite and its toxins. This seems especially likely where the parasite inhabits the vascular system, and gives rise to an eosinophilia. Bahr [7] has already drawn attention to the possible toxic factor in the production of the pathological lesions in filariasis. Considering the similarity in these lesions to those seen in bilharziasis, one can with certainty predict a specific complement fixation reaction for the former disease following the preparation of a suitable antigen, such as an extract of infected lymphatic glands. The demonstration of such a reaction in filariasis would be of considerable value.

Section II.—Concerning Certain Early Clinical Aspects of Bilharziasis.

As a detailed account of the clinical aspects of early Egyptian bilharziasis will be published at a later date, only a brief outline of them will be given here. It was the existence of certain groups of early symptoms—called hereafter "toxæmic symptoms"—that first suggested the necessity for a complete investigation of the immunity response in bilharziasis.

The initial toxæmic symptoms of bilharziasis were first described in connexion with *Schistosoma japonicum*. Excellent descriptions of this stage of the infection were given by Edgar [8] in 1911, Bassett-Smith [9] in 1912, a Miyagawa [10] in 1913, and Laning [11] in 1914. The initial stage was characterized by a high afternoon pyrexia lasting from three to five weeks, a slow pulse, emaciation, œdema, and urticaria, pain in the upper abdomen, paroxysmal cough with occasional pulmonary dullness, diarrhœa or constipation, mental depression, and marked eosinophilia. Recovery from this stage followed, and subsequently the patient developed a bilharzial dysentery with the passage of ova of *S. japonicum*. There might also occur enlargement of the spleen, liver, etc., and finally ascites and death.

In 1914 Archibald [11A] described three cases of obscure pyrexia without eosinophilia which at autopsy were found to have intestinal bilharziasis (*S. mansoni*.)

In 1916 Lawton [12] noticed similar symptoms for the first time in Egyptian bilharziasis. They occurred amongst troopers of the Australian Light Horse stationed at Tel-el-Kebir on the sweet-water canal zone in the Delta.

The initial symptoms comprised abdominal pain, enlargement and tenderness of the liver and spleen; also pyrexia, urticaria, and diarrhœa.

A high-grade eosinophilia was always present, and the fæces contained lateral-spined ova. Subsequently these symptoms completely subsided.

From September, 1916, to June, 1918, I have had abundant opportunity of confirming and extending Lawton's observations. During this period seventy-five cases of bilharziasis amongst the troops have been carefully investigated. In addition to showing that the great majority of cases from Tel-el-Kebir (including those of Lawton's series) were mixed infections (*S. hæmatobium* and *S. mansoni*), a similar group of toxæmic symptoms was noted in a series of pure *S. hæmatobium* infection.

An analysis of these cases showed that thirty-eight out of seventy-five cases, or 50·6 per cent, presented early toxæmic symptoms. In these cases two stages were noted in the disease.

(1) A stage of toxæmia occurring from four to ten weeks after infection, and followed by recovery.

(2) A later stage of localized Bilharziasis characterized by vesical symptoms in *S. hæmatobium* infections, and by the intestinal symptoms in *S. mansoni* infections. Symptoms of the localized disease appeared at

a variable period—from three to eighteen months—after primary infection.

The cases showing the manifestations of a toxæmic stage were divisible into three groups :—

(1) Those presenting a syndrome similar to that described by Lawton, viz.: urticaria, associated with prolonged pyrexia, abdominal, and, perhaps, pulmonary symptoms. These were the common cases.

(2) Those characterized by urticaria, and pyrexia of less than ten days' duration—less common than group 1.

(3) Those presenting urticaria only. This occurred in only a few cases, It is thus seen that the toxæmic stage of the disease may be entirely absent, may be evidenced by symptoms of a profound toxæmia, or the symptoms may be so slight as to be almost neglected.

The variability of these toxæmic symptoms I believe to be dependent on the intensity of the infection, i.e., to the mass action of the toxin liberated by the maturing and adult worms and their ova.

In the following pages the immunity response in bilharziasis will be considered from the following aspects :—

(1) The cellular response as it is manifested : firstly, by changes in the circulating blood; and, secondly, by the vascular and tissue cellular reaction in focal bilharzial lesions.

(2) The humoral response as indicated by investigation of the complement fixation and the precipitin reactions.

Section III.—The Cellular Response following Bilharzial Infection.

Though a number of observations are already recorded on the blood picture in bilharziasis by Douglas and Hardy [13], Kautsky [14], Balfour [15], Day [16], Connor and Bazaret [17], and others, further work is required in view of the recent labours of Leiper [18] in demonstrating the existence of the two species of Schistosomata (*S. hæmatobium* and *S. mansoni*).

The object of the present study is twofold; it is :—

(1) To follow the changes in the blood picture during the different stages of the disease.

(2) To estimate whether any difference in the blood picture exists in pure infection with the two species of bilharzia, and whether any feature is accentuated in mixed infection with both species.

(1) *Observations on the Blood Picture in Man.*

(*a*) *The Cellular Response during the Toxæmic Stage of Bilharziasis.*—Most of the previous observations in this stage of bilharziasis have been made on infections with *S. japonicum.* Leiper has recorded an 85 per

cent eosinophilia in one of his cases; and Bassett-Smith noted in a naval officer an eosinophilia of 68 per cent, with a leucocytosis of 30,000 per cubic millimetre. Lawton's observations on the blood picture during this stage of Egyptian bilharziasis are the only ones recorded in the literature. He found a constant leucocytosis varying from 13,000 to 22,000 per cubic millimetre, the average count equalling 18,000 per cubic millimetre. Differential white counts yielded a high eosinophilia. The lowest eosinophilia was 36 per cent, the highest 76 per cent, and the average count was about 50 per cent. In cases examined immediately after the toxæmic symptoms had subsided, I have noted differential counts with forty-three per cent and forty-five per cent of eosinophile cells.

(*b*) *The Cellular Response during the Stages of Localized Bilharziasis.*—By the time the symptoms of localized bilharziasis have become established, the blood picture has changed considerably from that observed in the initial toxæmic stages of the disease. Both the total leucocyte count and the percentage of eosinophile cells have decreased.

In experimentally infected monkeys I have noted that in certain cases the total leucocyte count and the differential eosinophile count rapidly diminish, it may be even normal after the twelfth to the fourteenth week. In *S. japonicum* infections similar changes have been observed, but from observations on Australian troops it is evident that in Egyptian bilharziasis (both *S. mansoni* and *S. hæmatobium*) this decline is a more gradual one in man. From the fourth month onward there is a fall until the establishment of a moderate grade eosinophile and leucocyte count as indicated below.

(i) *Blood Counts in Vesical Bilharziasis* (*S. hæmatobium*), *made from the Sixth to the Eighteenth Month following Infection.*

In thirty-five cases the average total leucocyte count was 10,030 per cubic millimetre, the lowest count was 4,700, and the highest 21,870 per cubic millimetre.

In thirty-six cases the *average differential count* was as under:—

(1) Polymorphonuclears	45·1 per cent
(2) Lymphocytes	28·2 ,,
(3) Large mononuclears	12·6 ,,
(4) Eosinophiles	13·5 ,,
(5) Basophiles	0·6 ,,

In forty-seven cases the eosinophile count was as follows:—

In 7 cases the eosinophiles were under	5 per cent
,, 14 ,, ,, ,, between	5 and 10 per cent
,, 13 ,, ,, ,, ,,	10 ,, 15 ,,
,, 7 ,, ,, ,, ,,	15 ,, 20 ,,
,, 3 ,, ,, ,, ,,	20 ,, 25 ,,
,, 1 ,, ,, ,, ,,	25 ,, 30 ,,
,, 2 ,, ,, ,, ,,	35 ,, 40 ,,

In cases admitted to hospital at the undermentioned periods after initial infection the average eosinophile count was as follows:—

6 months	18 per cent
7 ,,	16·7 ,,
8 ,,	11·8 ,,
9—12 ,,	15·7 ,,
12—18 ,,	11·7 ,,

Excluding the cases admitted eight months after infection, the general tendency of the eosinophile count was to decrease from the sixth to the eighteenth month.

The average count showed an eosinophile leucocytosis, with also a constant increase in the large mononuclear cells, and a decrease in the polymorphonuclear elements.

These observations fully confirm the work of Day on the blood picture in early Egyptian bilharziasis.

There have been so few pure *S. mansoni* infections in the present series that it is not possible to give any statistical blood counts of them.

(ii) *Blood Counts in Mixed Bilharzial Infections (S. mansoni and S. hæmatobium), made from the Sixth to the Eighteenth Month after Infection.*

Cases of mixed infections with *S. mansoni* and *S. hæmatobium* gave the following results:—

In 29 cases the average total leucocyte count was	10,500 per c.mm.
The minimum count was	5,600 ,,
The maximum count was	22,500 ,,

In thirty-one cases the *average differential count* was:—

(1) Polymorphonuclears	44·4 per cent
(2) Lymphocytes	25·1 ,,
(3) Large mononuclears	10·9 ,,
(4) Eosinophiles	18·6 ,,
(5) Basophiles	1·0 ,,

Eosinophile count—

In 1 case the eosinophiles were under	5 per cent
,, 7 cases ,, between	5 and 10 per cent
,, 4 ,, ,, ,,	10 ,, 15 ,,
,, 8 ,, ,, ,,	15 ,, 20 ,,
,, 4 ,, ,, ,,	20 ,, 25 ,,
,, 2 ,, ,, ,,	25 ,, 30 ,,
,, 3 ,, ,, ,,	30 ,, 35 ,,
,, 2 ,, ,, ,,	40 ,, 45 ,,

The only difference in the blood picture from that of single pure infection with *S. hæmatobium* is the definitely higher eosinophilia—18·6 per cent in mixed infections, as against 13·5 per cent in single infections.

(2) *Observations on the Blood Picture, etc., in Monkeys experimentally infected with Egyptian Bilharziasis.*

The following observations are based on fifteen monkeys artificially infected with Egyptian bilharziasis.

Of eleven monkeys infected with *S. mansoni* two died of the disease.

Of four monkeys infected with *S. hæmatobium* three died of the disease.

At a variable time after infection, i.e., from the second to the sixth week, some or all of the following symptoms developed: Emaciation. anorexia, muscular weakness, tremor and definite shivering attacks. If the infected monkeys were going to die of the disease these symptoms increased in intensity; if recovery was to ensue they diminished. Following recovery, localizing symptoms supervened at a later date. In infection with *S. mansoni*, dysenteric symptoms not uncommonly appeared during the seventh to tenth week; in infection with *S. hæmatobium*, vesical ones were noted from the tenth to the twelfth week.

(*a*) *Observations on the Blood Picture, etc., in Monkeys spontaneously recovering from the Disease.*—In the ten monkeys that recovered from the initial toxic effects of a massive cercarial infection a remarkable cellular-humoral response was present in every case. The leucocytosis during the fifth to the twelfth week varied from 13,000 to 34,000 per cubic millimetre,

TABLE I.—OBSERVATIONS ON THE IMMUNITY RESPONSE

Monkey:	A	B	E	F	G	H	K
Species of infection:	*S. mansoni*	*S. mansoni*	*S. mansoni*	*S. mansoni*	*S. mansoni*	*S. mansoni*	*S. mansoni*
Week during which observations were made	11th	5th	7th	7th 8th	5th 7th	8th	6th
Complement fixation*	P +++	[illegible] +++	P ++++	P ++++ P ++++	P ++++ P ++++	P ++++	P ++++
Eosinophilia..	22·2 per cent	21·6 per cent	10·7 per cent	[illegible] per cent 63·[illegible] ,,	13·6 per cent 24 ,,	41·4 per cent	35 per cent
Leucocytes per cubic millimetre	15,000	13,200	17,500	15,600 28,000	10,600 [illegible]4,700	34,400	27,000
Recovery or death	Recovered	Recovered	Recovered	Recovered	Recovered	Recovered	Recovered
Post-mortem examination	Paired worms and lateral-spined ova found	Paired worms and lateral-spined ova found	Paired worms and lateral-spined ova found	Paired worms and lateral-spined ova found	Paired worms and lateral-spined ova found	Paired worms and lateral-spined ova found	Paired worms and lateral-spined ova found
Microscopic picture of liver	Pseudo-tubercles of Bilharzial origin and eosinophile infiltration in periportal zones; occasional ovum	Pseudo-tubercles of Bilharzial origin and eosinophile infiltration in periportal zones; occasional ovum	Pseudo-tubercles of Bilharzial origin and eosinophile infiltration in periportal zones; occasional ovum	Pseudo-tubercles of Bilharzial origin and eosinophile infiltration in periportal zones; occasional ovum	Pseudo-tubercles of Bilharzial origin and eosinophile infiltration in periportal zones; occasional ovum	Pseudo-tubercles of Bilharzial origin and eosinophile infiltration in periportal zones; occasional ovum	Pseudo-tubercles of Bilharzial origin and eosinophile infiltration in periportal zones; occasional ovum

* To obtain blood for the complement fixation test, the ventricle of the heart was punctured

The eosinophilia varied from 10 per cent to 63·2 per cent. The average eosinophile count on the ten monkeys taken during the fifth to the twelfth week of the disease equalled 28 per cent. In every case a positive complement fixation reaction was demonstrated by the seventh week of the disease. Not infrequently a strongly positive reaction (P + + + +) was obtained as early as the fifth week after infection.

(*b*) *Observations on the Blood Picture, etc., in Monkeys dying early from the Disease*—In the five monkeys that died early from the toxic effects of bilharziasis emaciation and muscular weakness became extreme. No evidence of a cellular-humoral response could be detected in these cases. The animals died either from the effects of an overwhelming toxæmia before there was time for an immunity response, or if they survived longer the intensity of the toxæmia caused a complete depression of the mechanism of immunization.

IN EXPERIMENTALLY INFECTED MONKEYS.

L	N	O	I	P	S	U	T
S. mansoni	*S. mansoni*	*S. hæmatobium*	*S. mansoni*	*S. hæmatobium*	*S. hæmatobium*	*S. hæmatobium*	*S. mansoni*
6th 12th	4th 12th	5th 9th	8th 9th	3rd	5th	2nd	8th
P+++ P++++	Negative P+++	P++++ —	Negative Negative	Negative	Negative	Negative	Negative
23·4 per cent 30·8 "	15·5 per cent	11·3 per cent 16·6 "	—	0·6 per cent	—	0·3 per cent	11·9 per cent
—	13,800	7,500 18,800	2,500 1,250	2,200	2,200	3,000	8,800
Recovered	Recovered	Recovered	Died	Died	Died	Died	—
Paired worms and lateral-spined ova found	Paired worms and lateral-spined ova found	Paired worms and terminal-spined ova found	Paired worms and lateral-spined ova found	—	—	—	Paired worms and lateral-spined ova found
Pseudo-tubercles of Bilharzial origin and eosinophile infiltration in periportal zones; occasional ovum	Pseudo-tubercles of Bilharzial origin and eosinophile infiltration in periportal zones; occasional ovum	Pseudo-tubercles of Bilharzial origin and eosinophile infiltration in periportal zones; occasional ovum	Pseudo-tubercles of Bilharzial origin and eosinophile infiltration in periportal zones; occasional ovum	Cloudy swelling of parenchyma vascular engorgement; periportal infiltration with mononuclear cells	Cloudy swelling of parenchyma vascular engorgement; periportal infiltration with mononuclear cells	Intense cloudy swelling of parenchyma	Pseudo-tubercles of Bilharzial origin and eosinophile infiltration in periportal zones; occasional ovum

and the requisite amount of blood (5 c.c.) aspirated with a 10-c.c. syringe.

Thus the sera of these five monkeys *never* yielded a positive complement fixation reaction. In all cases there was a progressive leucopenia and an entire absence of eosinophilia with one exception. This exception occurred in Monkey "T" who, during the ninth week, showed an eosinophilia of 11·9 per cent.

Table I presents in tabulated form some of the observations made. It may here be noted that most of the monkeys were grivet (*Cercopithecus*); "O" and "T" were of the species *Macacus rhesus*. In the grivet the eosinophile is similar to the human eosinophile, but the cytoplasm retains the basic stain longer than usual. It was therefore found necessary, in staining by Leishman's method, in order to demonstrate the eosinophile nature of the cell, to wash out longer than for the usual period with distilled water. In the *Macacus rhesus* this procedure is unnecessary. In every case prior to cercarial infection the blood of each monkey yielded a negative complement fixation test, and the normal total leucocyte and differential white counts were observed.

(*c*) *The Cellular Response observed in the Focal Bilharzial Lesions of the Organs of Infected Monkeys.*—As I propose to describe at a later date in greater detail pathological changes of a widespread and toxic nature in monkeys dying in the first few weeks of the disease, I shall briefly refer here to the main features.

In the most acute form no focal lesions are observed. The monkeys die of an acute toxæmia with diffuse cloudy swelling of all organs (see table).

The appearance of pseudo-tubercles on the surface of and throughout certain viscera, at post-mortem,was the outstanding feature in later stages, Their distribution differed somewhat in the two species; whereas in *S. hæmatobium* infection these were found in the intestine, liver, lungs, and pelvic organs, in *S. mansoni* infections they were confined to the two former organs.

Such a pseudo-tubercle on microscopic section presents a picture of eosinophile infiltration, formation of giant cells, and mononuclear infiltration, and sometimes a central caseation in addition. Such findings are comparable to the findings of Bahr [19] in acute filariasis.

As these changes are not strictly confined in microscopic section to the vicinity of either the adult worms or their ova, it is reasonable to conclude on pathological grounds alone that they result not from "mere mechanical" irritation, but from a widespread and diffusible toxin produced by the adult worms, and possibly by disintegrating ova.

(3) *Résumé.*

(1) Observations on bilharziasis both in man and in experimentally infected monkeys show that the cytological response to the bilharzial toxins is an eosinophile cell. These cells are present in increasing numbers not

only in the circulating blood, but also in the local bilharzial lesions, whether in the liver, intestine, bladder, uterus or lung, and are independent of the species of infection (i.e., *S. hæmatobium* or *S. mansoni.*)

(2) An identical cellular response results from either species of infection—whether due to *S. mansoni* or *S. hæmatobium.* The presence of a mixed infection evokes a higher eosinophilia than does a single one. Similarly, a microscopic examination of the local lesions in the two different species of infection reveals no essential difference in the cellular response locally, nor indeed in the focal pathological picture.

(3) Following invasion of the host by bilharzia cercariæ an eosinophile leucocytosis of marked intensity becomes established about the fifth to the eighth week of the disease. In experimentally infected monkeys, within this period of time, a leucocytosis, of 34,000, together with an eosinophilia of sixty-four per cent, has been observed.

(4) In man, after persisting for a few weeks, this abrupt rise in the eosinophile elements of the blood is followed by a steady decline for several months, until a moderate-grade eosinophilia and leucocytosis are established. Thus, in observations from the sixth to the eighteenth month of the disease, the average count was as follows:—

In pure *S. hæmatobium* infections the leucocytosis equalled 10,030 per cubic millimetre, and the average eosinophilia was 13·5 per cent.

In double infections (*S. hæmatobium* and *S. mansoni*) the leucocytosis equalled 10,500 per cubic millimetre; the average eosinophilia was 18·6 per cent.

In the chronic stage of bilharziasis (i.e., of many years' standing), the eosinophilia is a much less constant feature of the disease. The incidence of a secondary pyogenic infection engrafted on to a bilharzial ulceration—whether vesical or intestinal—results in a masking of the eosinophile cells by inducing in response to it a polymorphonuclear neutrophile leucocytosis.

(6) In bilharzial disease eosinophilia may be absent :—

(*a*) In cases of hyper-infection during the early toxæmic stage of the disease. (See Table I.)

(*b*) In milder cases of the disease, even during the early stages of localized bilharziasis.

(*c*) In chronic bilharziasis, especially if associated with a secondary pyogenic infection.

(7) From a diagnostic standpoint the presence of an eosinophilia may be a material aid to diagnosis. In the early stages of the disease its value is undoubted. It is not so constantly present during the stages of early localized bilharziasis, and in chronic bilharziasis its value is less certain still. It never affords so constant or so certain an index to diagnosis as the complement fixation reaction now to be described.

Section IV.—The Complement Fixation Reaction in Bilharziasis.

The frequency with which urticaria, fever and other symptoms were observed in the early stages of bilharziasis amongst Australian troops strongly suggested the presence of some exotoxin, the product of the maturing or of the adult worms. Seeing that these initial symptoms subsided after a variable period and the patient completely recovered until such a time as the signs and symptoms of localized bilharziasis supervened, it seemed to me probable on *a priori* grounds that recovery should be accompanied by the formation of some specific immune body in the blood.

In order to investigate the presence of this hypothetical immune body in the blood of bilharzial patients the ingenious method of fixation of complement described by Bordet and Gengou [20] in 1901 was utilized. A specific antigen was prepared from the livers of snails (*Planorbis boissyi*), infected with *S. mansoni*, and after several weeks' preliminary experimentation I was able to report in May, 1917, the discovery of a positive complement fixation test for bilharziasis more specific for this disease than is the corresponding Wassermann test for syphilis. During the past twelve months more than 600 specimens of sera (from cases of bilharziasis, from cases of other specific diseases, as well as from normal healthy people) have been investigated with remarkably satisfactory results.

(1) *The Phenomenon of Complement Fixation.*

The complement fixation reaction is dependent on the fact that when antigens inactivated serum containing immune body and complement are mixed together, immune body firmly combines with complement in such a manner that complement can no longer be demonstrated in the mixture. If such a mixture is incubated at 37° C. for one hour or more, and to it is added a suspension of sheep's red blood corpuscles sensitized with a suitable quantity of inactivated hæmolytic serum (obtained by injecting increasing doses of sheep's corpuscles into rabbits), no hæmolysis will take place, since there is no free complement. This absence of hæmolysis constitutes a positive reaction and proves the presence of specific immune body in the inactivated serum. If the complement is not fixed then hæmolysis ensues. This constitutes a negative reaction and demonstrates the absence of specific immune body in the serum under investigation. The essential problem in applying the complement fixation test to any new disease is centred in the production of an antigen which will yield a high percentage of positive reactions diagnostic of the illness under consideration, and at the same time will prove *specific* for that disease only, that is to say, will not give pseudo-reactions with the sera of subjects suffering from other infections.

During the present investigation two different antigens have been utilized, one a saline extract, the other an alcoholic extract of the livers of infected snails. The latter antigen has proved the more satisfactory of the two.

(2) *Technique employed in the Complement Fixation Test for Bilharziasis.*

As in other complement fixation reactions, it must be realized that this test is essentially a *quantitative*, not a qualitative one. It is dependent on the fact that this specific cercarial antigen, in the presence of serum from a patient infected with bilharziasis (immune body), will fix a greater quantity of complement than it will in the presence of an average pooled serum derived from non-bilharzial subjects. As in the analogous Wassermann reaction, accurate standardization of the various reagents used in the test is necessary.

In the first stage of the reaction a known quantity of standardized antigen is mixed with a known quantity of inactivated patient's serum in the presence of graded quantities of complement of an ascertained strength. This system is incubated for one hour at 37° C. After this incubation is complete a given quantity of sensitized sheep's corpuscles is added to the system, and the whole incubated at 37° C. for another hour. During this period of one hour's duration readings are made at intervals of a quarter of an hour, the readings made at the end of the hour being taken as final.

Antigen.—The preparation of the two different antigens used during this investigation is as follows :—

Antigen (A), *Saline Extract.*—A number of infected snails' livers were macerated in a solution composed of 0·85 per cent saline and 0·5 per cent phenol. The amount of fluid added was dependent upon the number of snails' livers utilized. The most satisfactory standard was found to be one cubic centimetre of solution to each snail liver. Thus, if the extract were to be made from twenty infected livers, then twenty cubic centimetres of solution were added. This mixture was shaken thoroughly on an electric shaker for twenty minutes, and then incubated at 37° C. for twenty-four hours to permit of extraction; it was then filtered, and the *fresh* filtrate used as antigen.

Antigen (B), *Alcoholic Extract.*—A number of snails' livers were macerated in a quantity of absolute alcohol—generally thirty livers in thirty cubic centimetres of alcohol. This mixture, after thirty minutes' thorough shaking on an electric shaker, was then incubated for twenty-four hours or longer at 37° C., being shaken at intervals. The mixture was then filtered. Next, the filtrate was evaporated by means of a Sprengel's exhaust-pump, air being drawn through the solution which was kept at 45° C. on a water-bath. When thoroughly dry, the residue was weighed. This was accomplished by weighing the tube while empty and afterwards weighing it again containing the evaporated residue, and then estimating the difference between the two.

In standardizing for use, twenty cubic centimetres of solution of 0·85 per cent saline and 0·5 per cent phenol were added to 0·05 grm. of this residue. The resultant mixture was shaken for thirty minutes or more on the electric shaker and filtered. This *fresh* filtrate was used as antigen.

On standing it tended to become opalescent, and was of a canary-yellow colour.

In the series reported on a fresh alcoholic extract was always used, since enough infected snails were always easily obtainable. Some of the sera, however, were also tested against an antigen prepared from alcoholic extract of snails' livers that had been stored on ice for five months. The results were fairly satisfactory, though the long-stored antigen proved less sensitive than the freshly prepared one.

After considerable investigation the saline extract (antigen "A") was discarded, and the alcoholic extract (antigen "B") substituted. The reasons for regarding the alcoholic extract as superior are as follows :—

(1) A higher percentage of positive results was obtained with the alcoholic extract in bilharzial infection.

(2) There was no tendency to pseudo-reactions in non-bilharzial sera.

(3) Accurate standardization of the alcoholic extract could be more easily carried out.

Complement.—The complement was obtained from well-nourished healthy guinea-pigs and collected under sterile conditions. Accurate standardization of complement was always carried out. The M.H.D. (minimum hæmolytic dose) was obtained. In the final test six and twelve M.H.D.s were used.

A positive diagnosis was made where an inactivated serum fixed six M.H.D.s of complement in the presence of specific antigen.

Arrangement of System for the Final Test.—Three rows of tubes as shown below :—

This series contained :—

Row No. 1.

Antigen	0·1 c.c.	Made up to 0·5 c.c. with 0·85 per cent saline
Patient's serum	0·1 ,,	
Diluted complement (six M.H.D.s)	0·1 ,,	

Pipettes of known calibre, standardized by the Morse gauge (Donald's method), were used to obtain the right volumes of the reagents.

Row No. 2.

Antigen	0·1 c.c.	Made up to 0·5 c.c. with 0·85 per cent saline
Patient's serum	0·1 ,,	
Diluted complement (twelve M.H.D.s) ..	0·2 ,,	

Row No. 3.

Patient's serum	0·1 c.c.	Made up to 0·5 c.c. with 0·85 per cent saline
Diluted complement	0·1 ,,	

This row (3) serves as a serum control, and any anti-complementary tendency in individual sera examined can easily be demonstrated.

Additional controls used in the test were :—

(1) Antigen control—antigen, one cubic centimetre made up to 0·5 cubic centimetre with 0·85 per cent saline.

(2) Pooled negative sera.

(3) Sure positive sera.

The quantity of antigen fixed by a pooled negative serum was also determined by adding varying amounts of complement.

The following is an Interpretation of the Sign utilized in recording the Results.

P ++++	100 per cent of complement fixed	..	Complete fixation of complement in tubes 1 and 2
P +++	75 ,, ,, ,,	..	Complete fixation of complement in tube 1. Partial hæmolysis in tube 2
P ++	50 ,, ,, ,,	..	Complete fixation of complement in tube 1. Complete hæmolysis in tube 2
P +	25 ,, ,, ,,	..	Complete fixation of complement in tube 1. Complete hæmolysis in tube 2

Note.—A P+ reaction on the above basis was regarded as positive evidence of bilharzial infection only in the presence of strong clinical signs of the disease.

Hæmolytic Serum.—This was obtained from rabbits by intraperitoneal injection of increasing doses of sheep's corpuscles which had been repeatedly washed in saline. The serum used was of high titre, active in 1 to 4,000 dilution. To sensitize the sheep's corpuscles, four M.H.D.s of amboceptor or hæmolytic serum were used. The M.H.D. of amboceptor was taken to be that amount of hæmolytic serum which, with four to five M.H.D.s of complement, was sufficient to produce in one hour at 37° C. complete hæmolysis in one cubic centimetre of a five per cent suspension of sheep's corpuscles.

Sheep's Corpuscles.—Equal quantities of sheep's blood and two per cent sodium citrate in physiological saline were mixed together. Required amounts of this mixture received three washings with nine times the volume of physiological saline and were finally made up to a five per cent suspension of sheep's blood in physiological saline.

Sensitization of Corpuscles.—After four M.H.D.s of amboceptor had been added to the suspension of sheep's corpuscles the mixture was incubated for thirty minutes at 37° C. After completion of sensitization in this way, the suspension of corpuscles was kept in an ice-chest till required for use.

Patients' Sera.—Blood was usually obtained on the day preceding the test and kept in the ice-chest till required. The serum was then diluted with four times its volume of physiological saline and heated to 56° C. in a water-bath for twenty-five minutes. By so doing, all complement was destroyed.

Note.—It is necessary that sera should be not more than forty-eight hours old.

(3) *Significance of the Complement Fixation Reaction in Bilharziasis.*

If a microscopic section of a heavily infected snail's liver be examined, it will be noted that the great mass of the liver substance is in reality composed of sporocysts and cercariæ. They distend the inter-acinous spaces, and cause atrophy of the parenchyma. Such being the case, it follows that any extract of such an organ is largely an extract of sporocysts and cercariæ.

On several occasions antigen was prepared by making extracts from cercariæ which had been floated out from the liver substance, but such extracts were no more efficacious than those of infected liver itself, and were much more difficult to prepare.

On another occasion an antigen was prepared by making an alcoholic extract of adult worms collected post mortem from the portal system of an Egyptian who had died of bilharziasis. The great difficulty of obtaining a sufficient quantity of worms made the manufacture of such an antigen impracticable.

In order to demonstrate that the specific action of this antigen depended on the presence of bilharzial cercariæ, and was independent of any extract derived from normal snail's liver, or from degenerative changes induced by parasitic invasion of that organ, the following experiments were carried out.

Experiment I.—A saline extract was prepared from thirty normal livers of *Planorbis boissyi* for use as an antigen, and the identical technique was used as for the preparation of antigen "A." Fifteen bilharzial sera and a number of known negative sera were tested against this antigen. Absolutely no tendency to complement fixation was shown by any of the bilharzial sera.

Experiment II.—An alcoholic extract was prepared from livers of snails of the species *Bullinus dybowski* infected with the *Gastrodiscus ægyptius* cercariæ; from this an antigen was produced by a technique similar to that described for antigen "B."

A number of known bilharzial sera were tested by the complement fixation reaction against this antigen, and *all yielded negative results*. The point is that this antigen must have contained products of the degeneration of the liver tissue, produced during the growth of sporocysts and cercariæ, and also a concentrated extract of the single-tailed pigmented cercariæ of *G. ægyptius* (Cobbold) as well.

It follows, therefore, that the antigenic properties of the extract of snails' livers infected with bilharzia must be dependent upon specific substances extracted from the cercariæ themselves.

The antigen therefore is quite specific and in this respect differs entirely from the antigen used in the Wassermann reaction for the detection of syphilitic immune body. Syphilitic antigen is non-specific in so far that a variety of substances of a lipoidal character act equally as efficaciously as does antigen prepared from an extract of *Treponemata*

pallida, or as an extract, whether it be saline or alcoholic, prepared from a syphilitic liver.

Furthermore, this reaction is more specific than is the Wassermann reaction in another sense of the term. Prolonged experiments with a variety of sera have failed to demonstrate any constant tendency to pseudo-reaction in any disease or group of diseases. The sera tested include those of relapsing fever, syphilis, tuberculosis, enterica, hyatid disease, other helminthic infections, pellagra, etc.

In the case of the Wassermann reaction there are several allied protozoal diseases—such as yaws, relapsing fever, trypanosomiasis, and perhaps malaria as well, which give quite commonly pseudo-positive complement fixation reactions.

In the majority of my serological investigations an antigen prepared from snails of the species *Planorbis boissyi* infected with *S. mansoni* was utilized. This antigen was found to be specific for *S. hæmatobium* infections as well. In a similar fashion, an antigen prepared from Bullinus snails infected with *S. hæmatobium* cercariæ was found to be quite efficacious in detecting either of the two varieties of bilharziasis, *S. mansoni* or *S. hæmatobium.* The similarity of the initial toxic symptoms in man would suggest that a similar toxin is given off by both worms, and the above experiments bear out this contention. It is probable, then, that a similar test is applicable to *S. japonicum* infections as well.

In view of all these observed facts I regard this complement fixation test as a true Bordet-Gengou reaction, dependent on the fixation of the complement by a specific immune body which exists in the sera of bilharzial patients, in the presence of its specific cercarial antigen.

(4) *An Investigation of the Sera of* 311 *Hospital Patients using as Antigen a Saline Extract of Infected Planorbis Snails' Livers* (*Antigen* " *A* ").

(*a*) In a group of cases whose bilharziasis was of not more than two years' duration, 39 out of 54 (or 72 per cent) yielded positive reactions.

(*b*) In another group of cases whose bilharziasis was of more than two years' duration, 31 out of 46 (or 67·4 per cent) yielded positive reactions.

(*c*) Thirty-five cases yielding positive *Wassermann* syphilitic reactions were all negative to my test, provided the saline antigen was freshly prepared and the sera not more than forty-eight hours old.

(*d*) One hundred and seventy cases suffering from various other diseases were examined. All yielded negative results. (In this series were included cases infected with ankylostomiasis, hydatid disease, *Ascaris lumbricoides*, pellagra, typhoid, tuberculosis, gonorrhœa, and many other diseases.)

(*e*) In twelve cases a tendency to pseudo-reaction was observed in non-bilharzial sera.

Of these twelve cases six yielded a P + reaction only: in the absence of the clinical signs of bilharziasis such a reading is regarded as valueless, so that these cases can be neglected.

Of the remaining six cases (i.e., 3·6 per cent of all negative sera examined).

1	yielded a	P ++++	reaction
1	,,	P +++	,,
4	,,	P ++	,,

In the case of these pseudo-reactions, three occurred when using an antigen seven days old, and might have been eliminated by the use of fresh antigen. The remaining three cases were definitely cases of pseudo-reactions with fresh saline antigen.

It cannot be too strongly emphasized that antigen prepared as a saline extract of infected snail's livers must be fresh when used. At times, such extracts, even if kept on ice, quite unaccountably develop anti-complementary tendency, and may lose their power of fixing complement in the presence of bilharzial immune body. A similar degeneration may be noted in other saline antigens prepared either as bacterial suspensions, or as simple extracts of syphilitic livers.

(5) *An Investigation of the Sera of 280 Cases using as Antigen an Alcoholic Extract of Infected Livers (Antigen "B").*

(*a*) In a group of 21 cases whose bilharziasis was under two years duration, 19 (or 90 per cent) yielded positive reactions.

(*b*) In a group of 85 cases whose bilharziasis was over two years duration, 65 (or 76·5 per cent) yielded positive results.

(*c*) Thirty cases yielding positive *Wassermann* syphilitic reactions were all negative to this test.

(*d*) One hundred and thirty-five other cases, in either normal health or suffering from various diseases, yielded negative results.

(*e*) *Pseudo-reactions were never met with.* In only one case was a positive reaction obtained where bilharzia ova were not subsequently demonstrated. This occurred in the case of a soldier who had bathed in a sweet-water canal known to be infective; he presented rectal and slight urinary symptoms. A single examination of the excreta proved negative. This investigation could not be regarded as complete, so that bilharziasis could not with certainty be excluded in this case.

(6) *Relationship between the Grade of Eosinophilia and the Complement Fixation Reaction in Man.*

In fifty cases of bilharziasis joint observations were made on the grade of eosinophilia and the complement fixation reaction, with the object of determining the relationship, if any, existing between the cellular and the humoral reaction to this parasitic invasion.

The observations may be recorded as follow:—

Group I.—In 23 cases of bilharziasis yielding an eosinophilia of from 1 to 10 per cent 16 (or 69·5 per cent) yielded positive complement fixation reactions. It may be observed, however, that the amount of complement

fixed was not as great as in the Groups II and III, i.e., the complement fixation reactions were not so marked.

Group II.—In 21 cases in which the eosinophile count was between 10 per cent and 25 per cent 18 (or 85·70 per cent) yielded strong positive complement fixation reactions.

Group III.—In 6 cases in which *the eosinophile count was between* 25 *per cent and* 40 *per cent,* 6 cases (*or* 100 *per cent*) *yielded strong positive complement fixation reactions.*

From these observations it will be seen that the higher the grade of eosinophilia present, the greater the tendency for the serum to give positive results by the complement fixation reaction. It must be emphasized, however, that positive complement fixation reactions have been obtained in a number of cases where the differential count has shown the proportion of eosinophiles as low as five per cent or under.

(7) *Practical Value of this Complement Fixation Reaction.*

There are two directions in which this test has a practical application.

(*a*) As a means of diagnosing cases of bilharziasis *very early in the disease* (prior to the onset of localizing symptoms in the bladder and intestine), and also as a method of diagnosis in later cases where localizing symptoms are obscure and ova are difficult to demonstrate.

(*b*) As a therapeutic index to the effect of a given drug on the bilharzia worms. In this respect this test stands in the same relationship to bilharziasis as does the Wassermann test to syphilis.

(*a*) *The Diagnostic Value of the Complement Fixation Reaction in Bilharziasis.*—Perhaps the practical value of the complement fixation test can best be realized by reports on the following groups of cases.

Report (1).—For three months the bloods of cases presenting urinary symptoms such as hæmaturia, pain, and frequency, were sent to me for examination from a number of British military hospitals in Cairo. In only three cases was I supplied with any previous information as to the presence of ova in the urine.

These cases were tested by the complement fixation reaction, using as antigen the saline extract of infected livers of Planorbis snails (antigen "A").

In fifteen cases a positive diagnosis of bilharziasis was made on the blood findings alone; of these

7 cases gave		P ++++	reaction
1	,,	P +++	,,
5	,,	P ++	,,
2	,,	P +	,,

Fifteen cases were reported negative; in eleven cases the cause of the urinary trouble was traced to other conditions such as nephritis, renal calculus, etc. In the four remaining cases bilharzia ova were demonstrated.

In only three of the fifteen yielding a positive complement fixation reaction ova were not found in the urine at that time, but cystoscopic

examination revealed a typical bilharzial lesion, and subsequently the ova were demonstrated in each case.

No pseudo-reactions were reported. Thus out of 19 cases of bilharziasis 15 (or 79 per cent) were diagnosed as positive, and this I would emphasize, using the inferior saline antigen.

Report (2).—An outbreak of bilharziasis occurred in Palestine in the Mounted Yeomanry, who had been bathing in sweet-water canals in the Fayoum during the previous summer. Systematic urinary examination of this unit had been made, and all the cases passing ova six weeks prior to my arrival in the vicinity had been diagnosed.

When the complement fixation reaction was investigated (which was performed in a field laboratory some ten to fifteen miles behind the firing line), six men who had previously been diagnosed still remained with their squadron; the remaining cases in whom no ova had previously been found were examined.

RESULT OF EXAMINATION.

No.	Urinary symptoms, if any	Urine	Eosinophilia	Cerebrospinal fluid reaction
1	Penile pain	Positive ..	8·2 per cent ..	P ++++
2	Hæmaturia	,, ..	2·9 ,, ..	P +++
3	,, ...	,, ..	2·5 ,, ..	P +++
4	Urethral burning, pain ..	,, ..	2·6 ,, ..	P ++
5	No symptoms	,, ..	6·6 ,, ..	P +
6	Hæmaturia	,, ..	6·6 ,, ..	Negative
7	Nil	Negative ..	19·6 ,, ..	P ++++
8	Urethral pain	,, ..	17·5 ,, ..	P ++++
9	,, burning	,, ..	10·9 ,, ..	P ++++
10	,, ,, ...	,, ..	8·2 ,, ..	P ++++
11	Hæmaturia	,, ..	7·2 ,, ..	P ++++
12	,, ...	,, ..	2·8 ,, ..	P ++++
13	Nil	,, ..	1·2 ,, ..	P ++++
14	Frequency	,, ..	6·2 ,, ..	P ++

The first six cases were known to be suffering from urinary bilharziasis when they were examined; one of these was negative. The last eight cases had no ova in their urine prior to the performance of the complement fixation reaction. Subsequently five of these eight cases showed ova in their urine; unfortunately I was not able to follow up the other three cases owing to military exigencies.

Report (3).—Thirty-three cases of urinary and rectal bilharziasis were examined from the Asylum of the Insane, Abbassia, through the courtesy of Dr. W. W. Warnock, C.M.G. Of these thirty-three cases:—

19 yielded P ++++ reaction.
1 ,, P +++ reaction.
9 ,, P ++ reaction.
1 ,, P + reaction.
3 cases were negative.

An alcoholic antigen (antigen "B") was used. Considering that many of these cases were cases of chronic bilharziasis with mental symptoms,

the results of the complement fixation test (i.e., ninety per cent positive finding) are extraordinarily satisfactory.

Report (4).—Thirty cases of advanced chronic bilharziasis from the Kasr-el-Ainy Hospital were examined through the courtesy of Professor F. Cole Madden, F.R.C.S.

Twenty-three out of the thirty cases yielded definitely positive results (i.e., P++++, P+++, or P++) reactions. The serum of two cases showed delayed hæmolysis, and five were negative. Three of the negative cases were moribund as a result of secondary septic complications (i.e., septic cystitis and pyonephrosis), engrafted on to a chronic bilharzial infection. One case was suffering from uræmia at the time his blood was tested.

Note.—At autopsy in a certain proportion of these advanced chronic cases bilharzia worms cannot be demonstrated. It is quite conceivable that, owing to secondary infection and repeated deposition of ova in the walls of such organs as the bladder and colon, these focal conditions may persist, and even cause death to the host (i.e., man) long after the primary cause (i.e., the worms themselves) have died off. Naturally in such cases, though being primarily of a bilharzial origin, one would expect to obtain a negative complement fixation reaction.

(*b*) *Complement Fixation Reaction as an Index to the Possible Therapeutic Action of Drugs in the Treatment of the Disease.*—All observations I have made on the serological test tend to show that it stands in much the same relationship to bilharziasis as does the Wassermann test to syphilis. It should afford an accurate index of the activity of the bilharzial worms in the body in much the same manner as does the Wassermann test in the case of *T. pallidum*. That such is the case is indicated by the higher percentage of positive reactions obtained in *early* bilharziasis as compared with those obtained in the chronic stages of the disease.

In the past it has been customary to estimate the therapeutic value of any drug in bilharziasis according to the following criteria:—

(1) The amelioration of vesical or intestinal symptoms.

(2) The diminution in the number of ova passed in the excreta (i.e., urine and fæces).

Such data, however, act only as an index to the amelioration of symptoms, but not to the cure of the disease.

Furthermore, ova may be deposited in the walls of hollow viscera (intestine and bladder), and thus imprisoned they may not be passed out in the excreta for many months, it may be even for years afterwards. What is really required is a reaction to test the activity of the worms in the veins; for such an index we now can look to the complement fixation reaction, and to a lesser degree to the eosinophile count.

The constant association of ova with local vesical and intestinal bilharzial lesions has in the past misdirected the thought of the clinician as well as the pathologist to regard the *ova*, but not the *parasites themselves*, as being the dominating factor in bilharziasis.

No less an authority than Looss taught that the essential therapeutic problem in bilharziasis resolved itself into the discovery of a drug which would dissolve the chitinous envelope of the ovum, and destroy the miracidium without at the same time injuring the human host.

In contradistinction to such a view, I hold that all forms of local treatment are useless from the standpoint of an ultimate cure, though symptoms may be temporarily relieved thereby.

The essential therapeutic problem then is to find some specific drug so lethal to the adult worms that it can be introduced intravenously in sufficient dosage to kill these parasites inhabiting the venous system, and yet not be excessively harmful to man himself.

Furthermore, it is to be remembered that the problem is to exterminate the parasites, not by the discovery of a drug producing its lethal effect by dissolving or permeating the tough outer coat, but by the discovery of one which during its ingestion along with the human blood (which is after all the normal food) will exert its specific parasiticidal action after absorption through the more delicate lining of the alimentary tract of the worms.

From the standpoint of experimental therapeutics, there can be few diseases affording such prospect of ultimate cure, thus:—

(1) The lethal action of various drugs on worms and cercariæ, kept alive in saline or other suitable solutions, can be estimated.

(2) Monkeys can readily be infected (heavily or otherwise, as may be desired), and the effect of the intravenous injection of any drugs which have been found to exert a lethal action on worms *in vitro* can then be tested.

(3) The complement fixation test, controlled ultimately by post-mortem examination on monkeys, readily affords an index of the effect of the drug under investigation on the parasites.

Time limitations, the pressure of routine work and the absence of suitable pharmacological co-operation, have prevented this line of research being followed out in detail. When one considers the widespread ravages of bilharziasis amongst the Egyptians, the urgent desirability for such an investigation, especially if instituted in conjunction with a synthetic chemist, must be obvious to all.

I investigated the effect of intravenous eusol in four cases of bilharziasis some twelve months ago, but all the cases are still suffering from the disease.

On *a priori* grounds there was no reason to hope for satisfactory results from this form of medication, for contrary to the views of certain observers [21] available chlorine was found to possess no special lethal effects on cercariæ. Thus, two and a half hours after immersion in water containing 4 parts per 1,000,000 of available chlorine, I found cercariæ alive and very motile, whereas as a bactericide 1 part per 1,000,000 is universally considered efficient.

The average number of injections in these cases was three, given at intervals of five days, and the sum-total of the amount injected in each case

was 200 cubic centimetres of eusol. No constitutional disturbances followed except slight rise of temperature and headache, and in one case loin pain. No change was noted in the differential eosinophile count nor in the complement fixation reaction in any of the four cases up to the third week after the intravenous injections of eusol. This treatment was therefore abandoned.

(8) *Deductions which can legitimately be derived from Experimental Work recorded above.*

(1) That from the cercariæ of the two species, *S. mansoni* or *S. hæmatobium*, a specific antigen can be produced which reacts with bilharzia-infected sera.

(2) That this is the first record of a specific substance having been isolated from the body of an invertebrate intermediary (Bullinus and Planorbis) infected with a human parasite, and which will react with human serum (i.e., that of the definitive host).

(3) That, *provided all the conditions which I have enumerated be fulfilled*, the test is still comparable in its results and is a more specific one than is the Wassermann reaction for syphilis, inasmuch as the tendency to pseudo-reactions appears to be less marked.

(4) That it has a practical bearing is shown by the high percentage of positive results maintained throughout the disease, but especially in the early stages, before the appearance of ova in the urine or the excreta. In this connexion it is applicable for the examination of large bodies of men, for instance, on entrance to a public service, under conditions in which it is reasonable to suppose that a larger number of *rectal* infections would remain undetected by the microscopical enamination of the fæces.

(5) By its practical application the discovery of the lethal action of a parasicitidal drug may be facilitated.

Section V.—Preliminary Note on the Investigation for the Existence of a Precipitin Test in Bilharziasis.

The demonstration of the presence of a positive complement fixation reaction in bilharziasis led to the hope that a precipitin test might also be obtained in the serum of this disease.

In order to investigate this possibility the following experiments were carried out:—

The livers of thirty Planorbis snails infected with *Schistosoma mansoni* were teased out in saline and incubated with thirty cubic centimetres of solution (composed of 0·85 per cent saline and 0·5 per cent phenol) for forty-eight hours, the mixture being shaken on an electric shaker. Subsequently it was filtered through a Chamberlain filter, and the filtrate (A) used for experiments.

The sera of two cases of human bilharziasis (mixed infections, i.e.,

S. mansoni and *S. hæmatobium*) and of two infected monkeys (*S. mansoni* infections) were utilized.

Three rows of tubes were put up in each case:—

In the 1st was	filtrate	(a), 0·5 c.c.	+	Bilharzial serum,	0·25	c.c.
,, 2nd	,,	(A), 0·5 ,,	+	,, ,,	0·5	,,
,, 3rd	,,	(A), 0·5 ,,	+	physiological saline,	0·5	,,

Additional controls were used in known negative sera and filtrate (which I have termed "A") in similar quantities as described above. All results were entirely negative, even after being left for forty-eight hours at room temperature. Further observations are being now conducted with higher grade dilutions of bilharzial sera.

Note.—No agglutination or parasiticidal action of bilharzial serum was noted on live cercariæ when the latter were suspended in bilharzial serum in coverslip preparations and observed under the microscope. The loss of oxygen is the main factor in immobilizing bilharzial cercariæ in coverslip preparations, as is clearly indicated by the saline or negative serum controls, and by the fact that some cercariæ placed in open test-tubes in identical solutions survive much longer than similar cercariæ placed in sealed coverslip preparations.

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POST SCRIPTUM.

Since the final completion of this article I have learned for the first time of the experimental work of Leiper on infected animals, reported on in the ROYAL ARMY MEDICAL CORPS JOURNAL, March, 1918, p. 239, which has just come to hand.

His conclusions are that none of the substances of *known* anthelminthic or cercariacidal value could be introduced into the portal system in doses lethal to adult parasites. I still think, however, that with a complement fixation reaction now available and with the potentialities of synthetic chemistry as yet unexplored, a rational optimism is justifiable and that further research along the line enunciated above is still urgently indicated.

WAR EXPERIENCES IN DYSENTERY, 1915-18.

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Now that the campaign in the Eastern theatre of war has come to a close it would not be inappropriate to call attention to some recently published articles on this disease as it occurred in the Egyptian Expeditionary Force.

The war in the East has, broadly speaking, proved to be a medical more than a surgical one. Medical officers serving in the Forces in Egypt soon discovered that, whereas a well-considered scheme for the diagnosis and treatment of surgical cases existed, there was no such well-ordered one for the diagnosis and treatment of tropical diseases, which have claimed by far the greater number of the casualties. The need for special instruction of pathologists in these diseases has been a great desideratum and it cannot be said that at the end of four and a half years this has been accomplished. An example of what we mean—founded apparently on insufficient knowledge or investigation—has been the almost universal usage of emetine for all cases of dysentery; in fact, this drug has become almost a fetish. At the commencement one may, with some justification, point out that the study of dysentery is one little understood by the majority of medical officers and the very nature of this group of diseases, of such varied etiology, entails an intimate knowledge of protozoology, bacteriology, and cellular pathology, in the details of which not every bacteriologist engaged in the diagnosis of war dysentery has had the advantages of a special training. It must be remembered that the ultimate diagnosis of a case of dysentery has remained almost entirely with the bacteriologist.

The remarks which ensue must then be read as an attempt not so much at destructive as at constructive criticism.

The first paper which has attracted our attention is one by Lieutenant-Colonel Cowan and Captain Hugh Miller, R.A.M.C., in the Journal of the Royal Army Medical Corps for September and October, 1918. From a clinical point of view, this paper strikes us as one of the soundest we remember to have read on this subject. But there are certain inferences and deductions drawn from the bacteriological or pathological standpoint, which seem to us to call for some explanation. What proof have we for the statement that at "Cape Helles amœbic dysentery was rife during July, August, September and October; while at Suvla Bay the main cause was bacterial." Apparently there is very little to support this view, which

is against all previous experience. Probably the bacterial cause of the disease came to be recognized the moment proper laboratories with trained bacteriologists were established.

It is not too much to say that the type of disease did not alter, but the methods of diagnosis did.

Furthermore the same argument holds good for the subsequent statement on hearsay evidence, that " while the dysentery in East Africa prior to the war was wholly amœbic, the bacillary affection has been frequently seen there since the arrival of Indian troops in the autumn of 1914." Surely there is no proof that bacillary dysentery has been "imported" into any tropical country of recent years; we know that this disease has an almost universal distribution and was most certainly present in East Africa before the war.

Amœbic Dysentery.—When discussing the etiology of amœbiasis the exact meaning of the endemic carrier rate of cysto of *Entamœba histolytica* has yet to be determined. Does the presence of *histolytica* cysts in an otherwise normal stool necessarily indicate that the individual who has passed that stool is suffering from an undetected amœbic ulceration of the bowel? From the frequency with which these cysts can be detected, often in small numbers it is true, in the fæces of people residing in Great Britain, where *amœbic dysentery is not known to occur commonly as an indigenous disease*, one rather gathers it does not (Yorke, *Transactions of the Society of Tropical Medicine and Hygiene*, July, 1918, p. 293, found 5·2 per cent of Army recruits and 19·5 per cent of the inmates of a lunatic asylum were carriers of these cysts. It was found, moreover, that whereas the carrier rate for convalescent dysenteries was 11·5 per cent it was almost as great, 7·8 per cent, in the case of convalescents from diseases other than dysentery. In discussing this paper Sir Wm. Leishman stated that he could testify that there had been no outbreak of amœbic dysentery in France.)

It would therefore be dangerous to infer on clinical grounds that British soldiers in Egypt were suffering from amœbic dysentery solely because the carrier rate for *E. histolytica* cysts in *native* Egyptians is rather a high one, 13·5 per cent (Wenyon and O'Connor, " Human Intestinal Protozoa in the Near East, p. 39). Again, is there any real basis for the statement that a double infection with the *E. histolytica* and the dysentery bacillus is by no means uncommon? We do not think there is. In an experience of ten years laboratory work on dysentery one of us (P. H. B.) has come to regard cases of this kind as being extremely rare. So much depends upon what one is going to dub a dysentery bacillus. The designation dysentery bacillus should be reserved solely for one or other of the two classical types agglutinating in high titre to specific Shiga or Flexner-Y sera.

Should a bacillary dysentery stool contain a few *histolytica* cysts, this does not indicate to our minds that the patient is suffering from an acute attack of both diseases.

Should active destruction of the bowel wall be in progress it is our experience that the amœbæ found in the stool will be large and will contain ingested red cells. This same view has been previously well expressed by Wenyon and O'Connor in their monograph (*op. cit.*, p. 46).

We entirely agree that in the microscopic diagnosis of amœbic dysentery a *single negative* examination is of little value unless due attention is paid to the marked differences in the cellular exudate in the two diseases (*cf.*, Willmore and Shearman, *Lancet*, August 17, 1918, pp. 200-206).

In considering the question of a double protozoal and bacillary infection, due regard should be paid to the characters of the bacilli isolated. Is there any proof that certain bacilli quoted *B. fæcalis alkaligenes*, *B. paracolon* A, streptococci, and *B. C. L. A.* 1-6 (dysentery-like bacilli isolated by the Central Laboratory, Alexandria), possess any pathogenic power at all in human beings? None of these organisms as far as we know, have been recognized as being capable of causing intestinal lesions. None of them satisfy Koch's postulates. Is there any proof that they cannot be found in abundance in normal stools, and even in typical bacillary dysentery stools after a period of decomposition? We contend that there is not, and the arguments in favour of this view are being published by one of us (P. H. B.) shortly.

We would emphasize once more that the real test of recognition of the true specific dysentery bacilli can only be based upon their agglutinability in high titre with specially prepared rabbit sera.

Bacillary Dysentery.—These authors make a statement without adducing any proof that carriers of the dysentery bacillus are by no means uncommon.

This appears to be quite contrary to the experience of other observers (*cf.*, Fletcher, Journal of the Royal Army Medical Corps, June, 1918; Whitehead and Kirkpatrick, *Lancet*, August 3, 1918, pp. 143-144). The latter investigators, out of an examination of 5,000 specimens, isolated Flexner-Y bacilli only twice from fæcal stools and Shiga's bacillus never at all. This coincides almost exactly with the experience of one of us (P. H. B.) during his work on this subject extending over a period of ten years.

That there appears to be a similar lack of appreciation of the pitfalls which beset the isolation of the dysentery bacillus, is evident in the statement that over half (58·8 per cent) of the cases with blood and mucus in the stools examined in Central Laboratory, Alexandria, no dysentery bacilli or entamœbæ were detected and the cause of the illness remained undetermined. Why? Because many factors (such as the period of the disease, length of time of decomposition of stool before examination, nature of any contamination, fæces, urine, etc.) all affect the probability of successful isolation of the dysentery bacillus. Some of these factors have been appreciated in standard works on the subject, as "Besson's Bacteriology," and Stitt's "Tropical Diseases." In fact, in investigating cases near the front

line, before the third day of the disease, the percentage of our successful isolations by P. H. B., in a series of 107 cases in September, 1917, was as high as seventy-eight per cent.

In no other disease are the niceties of bacteriological technique so necessary as in bacillary dysentery. For instance, it has been our experience that failure to isolate the bacillus has been due to the common practise of placing a small amount of cresol in the bedpan.

Taking this as well as the other factors that we have mentioned into consideration, it is obvious that the proper location of a dysentery laboratory should be in close proximity to the dysentery ward.

To our minds the statistics quoted from the Central Laboratory, Alexandria, from April to November, 1916, should show a far higher percentage of bacillary cases; in fact, a percentage which would approximate to the results obtained in a field laboratory in Palestine in 1918; viz., in 1,874 cases, seven per cent were amœbic and ninety-three per cent bacillary, which in our experience has been the proportion between these two diseases throughout the whole course of the campaign in the E.E.P.

We agree that, even in typical cases, the agglutination reactions of patients' sera with typical dysentery bacilli isolated from their own stools are indefinite, and as an aid to diagnosis untrustworthy.

The authors appear to be sceptical as to the existence of a "pure chronic bacillary dysentery." We agree that in properly tended and treated Europeans this condition is rare; however, it undoubtedly does occur in the much neglected Turk. One of us (P. H. B.) had the privilege of examining post-mortem fifty-five cases in Turkish prisoners in which the disease had lasted from two to three months. This condition showed as a sinuous transverse ulceration of the lower bowel with inflammation and sometimes tunnelling of the intervening mucous membrane. Out of twenty bacteriological examinations of ulcers of this type, Shiga or Flexner-Y bacilli were isolated in fourteen by means of scrapings from the floor of the ulcers. As a further proof no amœbæ were found in microscopical sections or in scrapings of the gut.

Another paper by Captains J. G. Thomson and L. F. Hirst, in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, working in the same area, may be read in conjunction with the clinical study already quoted. The only point in this paper with which we disagree is the stress laid upon the importance of these atypical strains of dysentery bacilli in military hygiene. As quoted in the paper, one of us (P. H. B.) was inclined to lay stress on these organisms in his original work in Fiji during 1910 (Report London School of Tropical Medicine, 1912), but with the recent improved methods of technique in the recognition of intestinal bacteria he has seen reason to lay less stress upon the atypical organisms and to confine himself, when talking of dysentery bacilli, to the two well recognized types.

These investigators appear to have isolated nearly as many atypical as typical strains of *B. dysenteriæ*. By atypical strains we infer they mean

Gram-negative, non-motile bacilli, fermenting the sugars with acid, but without gas production. Having produced thirty-nine atypical strains divisible into eleven types by employing six sugars in their peptone tubes, how many more one wonders, could be produced by employing twelve or more?

It is our experience that colonies of the so-called atypical organisms are easily recognizable on MacConkey plates, as well as on agar slopes, by their denser, more luxuriant and slimy growth. The remarkable point about the *true dysentery strains* is that they are often to be found only in small numbers on a MacConkey plate (*cf.* Martin and Williams, *B.M.J.*, 1918, April 20, pp. 447-448). They appear to be very delicate organisms and cannot compete with other more vigorous bacilli on cultures, such as *B. coli*, *B. acidi lactici*, *B. fæcalis alkaligenes*, and *B. pyocyaneus*. The statement holds good, that, *because the bacteriologist, after a single attempt cannot isolate a certain organism from a small portion of the patient's stool, it does not necessarily indicate that the bacillus is non-existent in the intestinal canal of the patient.* How often are enteric bacilli isolated on the second or third attempt from the fæces of carriers? We would here refer to Professor Browning's letter to the *Lancet* (May 25, 1918, p. 749) calling attention to Captain R. J. Mackie's work, performed also in Alexandria, on these organisms. He suggests that they do not have the epidemiological significance of the classical Shiga and Flexner-Y types.

With this we agree, but we do strongly differ from him that a considerable proportion of cases of dysentery in the East are attributable to these organisms. We assert once more that the proof for this statement is lacking.

We believe that the only test of the specificity of a bacillus is its agglutinability, and if this shows a markedly positive result it will always give the same classical biochemical reactions (sixty agglutinable dysentery bacilli of the two types tested by P. H. B. in September and October, 1917).

Could any bacteriologist at the present day be certain that a bacillus isolated from normal stools, and giving the sugar reactions of a paratyphoid bacillus, but non-agglutinating with a homologous serum, was in fact an enteric organism.

In considering the cases of dysentery which we have seen among the units of the Egyptian Expeditionary Force from 1915-1918 several points in diagnosis and treatment have impressed themselves on our minds.

All over the sphere of army operations dysentery of the bacillary type has accounted for the very large majority of these cases. We wish to emphasize this statement, as in our opinion too great stress has been and still is laid on the prevalence of the amœbic type.

We disagree with those observers, many of them in England, whose writings tend to show that it was the amœbic type that was mainly responsible for the illness among the troops in certain areas and at certain times. In our opinion, although cases of amœbic dysentery are always

present, yet the epidemics that have occurred throughout the war area have been solely due to the *B. dysenteriæ*.

We are sceptical of the existence of cases of the so-called "mixed" type because we have never seen a case where active *E. histolytica* has been found in the stools from which *B. dysenteriæ* has been isolated. We admit that cases have presented themselves where the *cysts* of *E. histolytica* have been found in cases of undoubted bacillary type (case of Savage and Young in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, September, 1917, vol. xxix, No. 3, pp. 249-275).

The figures which we show prove conclusively to our minds the truth of this contention, and once this is admitted then the whole clinical aspect of things is changed.

What was the attitude of the temporary officers of the Royal Army Medical Corps towards dysentery in 1915?

Leaving out of consideration those who were trained protozoologists and bacteriologists and those who had some previous experience of tropical diseases, it may truly be said that the large bulk of the medical officers in the Egyptian Expeditionary Force had only the most vague ideas on the subject. Most men knew that there were two distinct types of the disease because they had different names.

Their knowledge ended when they had stated in the words of an officer, senior in years though not in service, "In amœbic dysentery you give emetine, in bacillary dysentery you give mag. sulph."

"The Discussion on Dysentery" held in Alexandria and published by the Army authorities at the end of October, 1915, amply shows the absence of accurate knowledge on the subject.

It may be said that the diagnosis was entirely in the hands of the bacteriologists. It still is, and rightly so, but at the same time certain features ought to be known by all medical officers to help them to deal with the cases to the best advantage, and to avoid indulging in a routine treatment, which, in our opinion, must have done considerable harm.

What was the routine treatment in 1915? It is summed up in the word "emetine," for it is true that the vast majority of cases of diarrhœa with blood and mucus stools got emetine by some method or another, irrespective of the type of the disease and very often without any serious attempt at accurate diagnosis having been made. There were two factors which made this treatment almost inevitable: (1) The enthusiastic claims made for the drug by Rogers after his experience with it as an improvement on pulv. ipecac. in India; (2) the inclusion of tubes of emetine tablets in the Army box of tablet medicines issued to all regiments and medical units. This latter was a temptation which few could resist.

In view of our figures of the relative frequency of the two types, we believe that this practice must have done harm for this reason: It is generally admitted that emetine has rather a depressing effect on the patient, and, although in a long series of *amœbic* cases no evidence of

cardiac dilatation was observed (Savage and Young), when the drug was given in varying form; yet in bacillary cases, where the patient is fighting a toxin of varying power, the administration of emetine will probably act as a severe handicap, and may turn the scale against the patient. All writers agree that many of their bacillary cases die of cardiac failure.

What then can be urged to take the place of this treatment which has become a routine? In our experience, it would be much more accurate to give to all cases, where no exact diagnosis can be made on the spot, an early dose of anti-dysenteric serum. Our experience, like that of many others, has been that this serum, when given in moderate dose in the early stages, is likely to be followed by the best results.

The war in Palestine has differed from the war in France in this respect: in France it has been a surgical war, in Palestine a medical one. The surgical prophylactic procedure is, that every wounded man gets an injection of anti-tetanic serum at the soonest possible moment. This we believe is generally done in a field ambulance. If this can be done for the many casualties in a surgical war, surely it is equally feasible, that in a medical war every case of clinical dysentery should have an initial dose of anti-dysenteric serum on admission to the field ambulance.

Someone is bound to ask, "Is this not prejudicing the chances of any amœbic cases that may crop up?" The obvious reply is that the very nature of the two complaints suggests that a minimum of harm is likely to result to the amœbic case left without emetine for another day or two.

Bacillary dysentery is an acute toxic disease which may kill in a few days under the best treatment, or, if it does not do so, it may result in irremediable damage to the mucosa of the gut and one cannot give the patient by any medical means a new intestinal canal.

Amœbic dysentery on the other hand is a much less acute disease, which frequently does not kill even after the most casual treatment. Emetine given ruthlessly and indiscriminately to all and sundry must handicap the chances of a bacillary case, in the absence of other treatment, and may do so even combined with proper treatment. Anti-dysenteric serum on the other hand has never, as far as we know, been known to act prejudicially on any case, whatever the nature of the disease. Army orders have been issued dealing with the amount of the initial dose of serum, but none dealing with the time it should be given, with the result that fully half of the cases of bacillary dysentery in the field do not get serum until after the third day of illness.

This we consider to be the crucial point, for in our experience a small initial dose (40 to 60 cubic centimetres), given whenever the patient is known to be passing blood and mucus, is of much more value than the larger dose (80 to 100 cubic centimetres) laid down by the Royal Army Medical Corps authorities as the initial dose, without respect to the day of the disease on which it should be given.

Our figures show that in the cases coming under observation early it

is comparatively easy to isolate the bacillus and our experience in the wards shows the immense value of early administration of serum.

But, if the work is to be followed out to a successful completion, there must be some correlation of treatment throughout the units comprising the medical lines of communication.

Unfortunately, this has not been the case in some instances and it is sometimes found that amœbic cases which have been given a good start by early diagnosis and preliminary emetine treatment are handicapped farther down the line by the withholding of further emetine treatment by some medical officer; probably on the grounds that the diarrhœa had ceased.

Comparatively few medical officers take an intelligent interest in dysentery. It has also been our fate to isolate a Flexner-Y bacillus from the stool of a patient who was then given sixty cubic centimetres of anti-dysenteric serum within thirty-six hours of the onset of the illness. This patient did very well; indeed, one might say that the one dose was a cure in this case. He was evacuated towards the base as he was unfit of course to return to duty for a while, and could not be retained occupying a bed in a busy clearing station. It can hardly be credited, that in a general hospital to which he went this man was subjected to a course of twelve daily one-grain doses of emetine hypodermically, and this without any evidence of amœbic dysentery having been found in the stools, and in face of the Flexner infection and consequent serum treatment clearly marked on his medical record.

Had this occurred in 1915 it would have excited possibly little comment, but, unfortunately, we have to admit that this happened during the last weeks of war.

We therefore suggest that attention should be paid to the following points by those responsible for the health of communities or armies in countries where dysentery is endemic.

(1) Blood and mucus stools, with or without tenesmus, mean dysentery, and at the earliest possible moment an experienced pathologist should report on the nature of the exudate.

N.B.—Amœbæ may not be found at first examination, but at least the exudate will indicate the probable type of the disease.

(2) If immediate microscopical diagnosis is impossible, give a moderate dose of anti-dysenteric serum and base further treatment on the result of laboratory findings when procured. Further serum treatment depends on the result of the initial dose.

(3) In amœbic cases emetine treatment must be consistent and a minimum of twelve grains given in daily doses of one grain each.

(4) Whatever the type of case treated by emetine or serum is only slightly more important than treatment by rest and dieting. In this connexion we wish to express our thorough agreement with the very complete scheme of diet laid down in the article already quoted by Cowan and Miller, and we suggest that it be taken as a standard.

SOLDIER'S HEART.[1]

By Captain ADOLPHE ABRAHAMS.
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In considering the subject of heart affections as they are encountered in soldiers it will be desirable in the outset to say a few words about the term "soldier's heart": one which has now acquired an accepted position in our nomenclature of diseases; one which certainly appears to supply a definite need in corresponding to a definite condition; but unfortunately also one which is employed with so much abuse that it is impossible not to regret that such a term should ever have been introduced. We ought to restrict its application to patients who are suffering from cardiac affections, or at any rate cardiac symptoms, due in some way to military service. In this sense, soldier's heart would be an occupation disease as we speak of miner's nystagmus, scrivener's palsy, or housemaid's knee. But whereas there exists a special group of cases which in my opinion corresponds to such a restriction even though the exact determining cause is still a subject for contention, the term is applied indiscriminately to a large variety of symptoms which are evident in men who happen to be temporarily khaki-clad, and most of which have nothing whatever to do with the heart, nor for that matter with military service.

And this reminds me to refer briefly to that question-begging epithet which is so conveniently employed in these days, D.A.H. (disordered action of the heart). Now whatever word of deprecation may be considered suitable to apply in the case of the aforementioned "soldier's heart" these fade into insignificance when you select those condemnatory enough for its blood-relation, D.A.H. I do not hesitate to say that I have seen men complaining of symptoms referable to every disease above the umbilicus sent in as D.A.H., and I am not at all sure that a certain number below this anatomical landmark have not been included. But even if one eliminates those cases of so-called D.A.H. which pass the first portal re-labelled N.Y.D. (not yet diagnosed), and are finally discharged as N.A.D. (no appreciable disease), what exactly does an honest attempt to use the words involve? What precisely is orderly action of the heart and when does chaos usurp the place of cosmos in the circulatory world? And in the second place is it not absurd at this stage of our knowledge of the etiology of disease to imagine that a diagnosis of tachycardia *is* a diagnosis

[1] A paper read before the Connaught Hospital Medical Society, November 30, 1916.

or that it is sufficient to say that a pulse is irregular or intermittent without taking the trouble to see what is the nature of the irregularity and if as a matter of fact its existence is of the slightest consequence?

In recalling to your memory the copious literature which has already appeared on the subject of "soldier's heart" during the last couple of years, I would suggest to you that a large variety of different conditions have been at various times described as if they were all the same thing. And I think the best way to support this proposition is to enumerate a representative collection of the causes which have been advanced.

First and foremost very naturally is the endeavour to ascribe all cases to exertion. Here then is our old friend "strained heart" or "athlete's heart" in modern form. To adapt the conditions to military circumstances such features are introduced as marches with weights, shoulder straps and the other paraphernalia of service and service kit.

The subject of heart-strain I will postpone to consider later in detail.

As a sort of corollary to this school, there is another which pre-supposes the existence of a great deal of latent unsuspected cardiac disease which only manifests itself in consequence of the strain, physical or mental or both physical and mental of military life.

To other authorities the condition is due to a toxæmia. If microbic influence is demanded, well, organisms are so easily introduced, from the teeth for example, or from the food itself; and even if you are deprived of organisms there are always toxins to fall back upon. And if toxins likewise are denied, there are perverted products of metabolism, and some authors blame the excessive protein diet of the soldier.

Another large group of authorities attribute the condition to the thyroid gland. The majority think there is hyperthyroidism, though a few believe the secretion to be normal in quantity but of pathological quality. The soldier's heart to this school is simply larval Graves's disease.

At least every other week somebody writes to the medical journals explaining "soldier's heart" to be due to excessive cigarette smoking; and considering the almost universal prevalence of this vice such an opinion has at least the support of reasonableness.

Recently "soldier's heart" has been attributed to deficiency of buffer salts in the blood, and such an explanation is not without its inconvenience in view of the difficulty in technique in estimating these salts, more especially as I will be impertinent enough to hint that the majority of us are more than vague as to what a buffer salt is, what it does, and why its absence should produce symptoms of cardiac disease.

One turns next to an entirely different interpretation of "soldier's heart" in introducing the school which support a psychical origin. Its disciples see no necessity to invoke the existence of any organic pathological cause. In fact they see no necessity to suppose the existence of any sign of heart disease. They point out that the symptoms, although equally familiar in genuine heart trouble, are quite easily or at least speciously

explainable on a non-organic basis, and that a man who has hitherto adapted himself to the most sedentary life, suddenly forced into the activity of unaccustomed exercise, pants and puffs and finds it much easier to sit down than to try to keep going. The symptom of præcordial pain in such cases is generally indigestion due to bad teeth. Now it seems to me that every one of these explanations is probably right, that is to say that among the enormous number of cases one meets in the Army with symptoms of breathlessness on exertion, or præcordial pain and of general so-called cardiac distress, there are some which may be explained in every one of these ways. And if I may venture to criticize those of far greater experience to whom we look for guidance, I think they have often made the mistake of laying too much emphasis upon the particular condition they are describing to the exclusion of absolutely all else; and, unconsciously and of course unintentionally, giving the impression that they were dealing with the whole of the cases comprised under "soldier's heart."

I hold the view that the large majority of cases which are labelled "soldier's heart" and condemned as unfit for active service have a perfectly normal myocardium, and suffer from symptoms which have no organic basis. I would then suggest to you that we may classify the cases which are sent up to us with symptoms or signs which might be referable to the heart in the following way:—

(1) Functional cases. A large number of men at the outset of their military duties who are free from any organic disease, but who have hitherto been quite unused to any form of exertion and readily display symptoms of distress or of fatigue.

(2) Cases with symptoms due to excessive smoking or other drugs, and disappearing upon appropriate treatment.

(3) Organic disease. (*a*) Valvular disease—(i) compensated, (ii) uncompensated; (*b*) myocardial disease; (*c*) adherent pericardium; (*d*) Graves's disease.

(4) Genuine soldier's heart.

I shall not deal with these groups *seriatim*, but I shall refer to them indiscriminately in considering general principles. The first general principle with which we should be concerned is the fundamental question of so-called overstrain of the heart. I would mention in passing that Sir Clifford Allbutt points out that this expression is tautologous, since all strain must be overstrain.

When one has the support of Sir James Mackenzie one need not hesitate to state dogmatically a disbelief in "heart strain" or "athletic heart." As a matter of fact, on purely empirical and not clinical grounds I never have believed in it, but it is one thing to state what is regarded as a worthless opinion based on inexperience and differing from common acceptation, and another to express a point of view which receives the cachet of the doyen of cardiologists. And Sir James Mackenzie says of "athlete's heart": "Personally I have never seen such a thing, and when

my opportunities of observation are considered, I think it will be allowed that I would have seen it if it had really existed." He says further: "I have had brought to me great numbers of young people of both sexes with hearts said to have been impaired by overstrain; I have not found a single case of dilatation with heart failure. That dilatation can be produced in a healthy heart as a result of overstrain, more particularly among the young and athletic, is a belief widely held. I am convinced that it is a view which is not justified. I never saw a single individual who suffered from heart dilatation as the result of over-exertion. I think I may fairly say that this was not due to inability to recognize overstrain." With such a sentiment as the last is there anybody who will disagree?

I cannot lay claim to an experience which would justify me in the presumption of endorsing an opinion of Sir James Mackenzie's, but I can at least claim a special experience which is in its way even greater than his. For eight years there has been practically no prominent athlete in any country in Europe (and a good many from the Colonies and from America) whom I have not had an opportunity of examining before and after exercise. I have been hunting the "athletic heart" all this time in sprinters, middle distance runners, Marathon runners, and I have never caught it. And yet it will be urged, our eminent predecessors published cases of dilated heart and overstrain which were clearly the result of exertion. In some cases a comparatively recent antecedent infection is definitely stated, in others it is hinted at, and in others again a coincidence is well worth noting, that both Sir Clifford Allbutt and the late Sir Lauder Brunton, describe cases of acute dilatation occurring during mountain climbing. Now the physiology at high altitudes is rather queer in itself; a large increase in red corpuscles has been shown to occur, and it is quite possible that by mere mechanical friction they retard circulation to some extent.

A priori there should be no expectation of the heart failing through pressure of work any more than of a diaphragm becoming fatigued. Nature is not likely to jeopardize the well-being of the most important muscle in the body, but safeguards it by ensuring that everything else shall give in first. When a man is badly done up as the result of a big effort, it is not cardiac failure but vasomotor exhaustion from which he is suffering, and his symptoms are due to nothing more serious. Personal experiences, however feeble, have at least a certain peculiar merit which is my excuse for obtruding these. During sixteen years of practical continuous competitive athletics, I have known frequently what it feels like to be badly run out or rowed out, but I remember only two special instances which stand out prominently. On the first occasion I had won a particularly hard 200 yards race, and I can only attribute the nausea, dyspnœa, and dreadful headache, from which I suffered the rest of that day, as due to an extra effort induced by an exceptional keenness to win. Had I sought advice for my symptoms, I might still be in bed or just beginning graduated

exercises; but as this was the middle of a big athletic season, I determined to adopt the best form of investigation I could think of, and the following morning I went out and ran, with very great relief to my doubts, one of the finest quarter-miles I have ever run. The second occasion was six years ago. Starting from Grindelwald, I went up the Faulhorn and down, practically without a stop, in four and a half hours. One hour after I had reached the bottom, I began to experience intense nausea, and I fainted. I believe that these symptoms were due to the exhaustion from want of food. Once again alarm demanded a critical investigation, and forty-eight hours later I went up the Faulhorn as hard as I could go; but on this excursion I ate a good *déjeuner* and rested for an hour at the top before running down, and I had not the slightest symptom of distress of any kind.

It is easy to understand how soldiers on the march faint, especially in hot weather, when their peripheral vessels are dilated to such an extent as to deplete the brain. Of course some people are much more liable than others to these attacks from the particular tendency of their blood to drain into the large abdominal veins. Such attacks too are largely precipitated by the boredom of a march. The fatigue of disheartenment is a very well-recognized thing.

I put it to you that physical exertion is mainly a matter of will-power. Some men have the will to drive the engine harder than others. But, granting no flaw in the machinery, nobody can drive it to breaking point.

In the consideration of *organic disease of the heart* we have first to deal with the question of *cardiac murmurs*. Sir James Mackenzie says: "The presence of a murmur is often considered to be inconsistent with the idea of a healthy heart, and the great bulk of the profession and the teachers of the profession do adhere to this view." Further he says, "Every graduate leaves hospital with but the vaguest notion how to assess the value of a murmur."

I think I may assert that there is not one of us here who does not almost every day see at least one striking example of the absurdity of worrying about the existence of a murmur *quâ* murmur—a survival of student days when prolonged arguments were wasted upon the exact timing of some miserable squeak, to say nothing of the decision whether there was any murmur there at all. As a consequence we gained the impression from our teachers that the slightest alteration in the character of the heart sounds meant serious organic cardiac mischief, and the fruit of this teaching has been, in civil life, the obstacles placed in the way of such people ever getting insured, and in military life the wholesale rejection of perfectly healthy subjects physically fit for anything; so depriving the country of a number of efficient soldiers, and, what is even worse, condemning to a serious restriction of useful and wholesome activity many men who for the rest of their lives walk about gingerly with the sort of sensation that they have a bomb inside them with the perpetual dread of sudden death.

Now so long as the heart does its work properly what does a little music in its mechanism matter? Some motor engines purr, others bark, and others roar, yet all may be equally efficient; and the murmur in the heart may bear no more relation to the heart's capacity for work than, to continue the parallel, need a squeak in a spring have anything to do with the engine.

Many murmurs are, of course, not cardiac at all but due to pressure relations of the pulmonary artery and the chest wall, or to some other simple extra-cardiac cause. The distinction of physiological murmurs is usually quite easy if one is not wedded to the idea that heart disease is so common that it must always be suspected. And although organic murmurs must in any case denote a certain degree of disability, even organic murmurs are not necessarily of much consequence. As a convenient rule, Sir James Mackenzie has said that a systolic apical murmur may always be disregarded when there is no sign of enlargement of the heart, for, as he says, "If a murmur is caused by a lesion which embarrasses a chamber in its work, that chamber will alter in form either by dilating or becoming hypertrophied." So that to talk of V.D.H. (valvular disease of heart) as a definite condition always calling for discharge from the Army as permanently unfit is quite unreasonable. To put it in the terms of common pleasantry, there is V.D.H. *and* V.D.H. The heart's capacity for doing work is the vital criterion and I am quite sure that many cases of well-marked valvular disease are little if any handicapped by their disability.

The heart muscle is of course the great factor in cardiac efficiency. If we could always measure the quality of the muscle we should find it easy to estimate the general condition of the heart, and the discovery of myocarditis with corresponding prognosis would be a simple matter. But a person's description of his inability to exert himself is in my opinion a very poor guide, although as you are well aware more than one cardiologist has stated that we are to accept a complaint of pain, dyspnœa, giddiness, etc., as absolute evidence of cardiac disability even in the absence of abnormal physical signs in the heart.

As aids in estimating the cardiac efficiency various tests have been elaborated, e.g., Grapner's, and various instruments have been invented such as the Bock stethoscope, the application of which has been particularly encouraged of recent date by Dr. O. Leyton. The tests depend upon the differences observed between the pulse-rates and blood-pressures in the resting state in the horizontal and erect positions and in the reaction to exercise. The Bock stethoscope is an arrangement which gives a numerical value to the audibility of the first sound at the apex and the second at the aortic base. A heart with normal musculature yields a ratio of 60:40. The nearer the ratio approaches unity the more the myocardium is affected. We have used the instrument fairly extensively here and have come to the conclusion that it has a useful application. The chief difficulty in our experience is the necessity for absolute silence during observation, other-

wise the error may be so great as to render the result quite useless. The instrument is said to be inapplicable when murmurs are present. It is unnecessary to deal with the well-known signs of obvious cardiac distress, e.g., cyanosis and œdema. It might be thought that *dyspnœa* is equally obvious as a sign of cardiac inefficiency, but in this sign there is the possibility of a large functional element. The majority of the ill-fed, flat-chested, poorly developed men who enter the Army after an uneventful sedentary life, and are then plunged into what is to them unalluring strenuous activity, naturally puff and blow and complain of pain in the chest. Again, the dyspnœa of what I call a case of real soldier's heart is often an hysterical polypnœa and calls for vigorous physical and mental discipline.

Pain on exertion is again a very vague symptom. The pain complained of by false cardiopaths is usually præcordial and not substernal as in true angina, and the pain does not radiate. It often disappears after effective dental treatment and especially if the man can be persuaded to overcome the inevitable distress of his first exertions and persevere. But once let a man get the idea that he has a weak heart and any hypochondriacal "pain in his heart" speaks to him of sudden death. Speaking generally we do not think of cardiac disease as associated with pain in the chest and when a man complains thus of his heart one is justified in thinking of his stomach.

Irregularity of the Pulse.—It is one of the most important and often one of the most difficult things to decide the meaning of a cardiac irregularity. The general tendency is to regard any divergence from a perfectly regular rhythm as evidence of cardiac disease. But, on the contrary, some forms of irregularity are of no pathological importance whatever; indeed, one form, sinus arrythmia, is even stated to be a particularly good sign that the heart is normal, a sort of hall-mark of a healthy heart. On the other hand there are types of irregularity which give an absolute indication of serious myocardial change, and their determination is far more useful than that of the size of the heart or of any murmur.

Sinus irregularity is a variability in the intervals of diastole. It can be produced in susceptible subjects by stimulating the vagus centre, e.g., by swallowing or deep breathing, for it is due to irritability of the centre. It can be completely abolished by exertion. Such an irregularity is as I have said of no pathological importance.

Extra-systoles, or, as they are more correctly termed, *premature contractions*, are recognized by the circumstance that the extra beat anticipates a regular contraction and is followed by a longer pause than after an ordinary beat. It is the long pause which is so unpleasantly apparent to the subject himself. Extra systoles are often of no pathological consequence and can be abolished by exercise. On the other hand they may indicate myocardial disease. They constitute therefore one sign only which has to be taken into consideration with all the other cardiac phenomena.

Pulsus alternans is a condition in which alternate beats are of unequal volume. It is a very grave sign of myocardial disease. It is obvious that some care is necessary to distinguish this condition from one in which premature contractions occur after every full beat. In the latter there is always a longer pause after the weaker (the premature) beat. In pulsus alternans the beats are regular and the intervals equal.

Auricular fibrillation is a condition of irregularity in which beats vary in frequency and volume in a completely irregular manner. It is not decreased but generally increased by exercise, and it is a sign of serious organic disease.

Heart-block in which the rhythm is disturbed at regular intervals by the dropping out of a beat is always a sign of serious heart disease.

Whilst it is the rarest possible thing for a soldier to be sent up as D.A.H. with *bradycardia*, the number sent up as *tachycardia* far exceeds the total of all the other cases. (I mean by tachycardia simply undue acceleration of the rate, whilst I would remind you that some authorities restrict the term to a special type of acceleration-paroxsmal tachycardia.) Now to speak of tachycardia as a distinct condition when it may be due to such diverse causes as acute peritonitis and drinking too much tea is as absurd as to label a case abdominal pain when this symptom may be due to indigestion, appendicitis, caries of the spine, pneumonia, or a host of other things. In the first place some people appear to have a physiological tachycardia and own a heart which runs normally at 110 perhaps and gives rise to no symptoms. When a patient complains of the usual cardiac symptoms it is clearly necessary to exclude all organic causes of tachycardia —e.g., tuberculosis, valvular disease, myocardial degeneration, adherent pericardium, Graves's disease, and any obvious functional cause, such as excessive smoking. We are then left with a residue of cases about which it seems impossible to decide, in which there is nothing definitely organic unless you invoke larval Graves's disease. In this type of case there is of course no exophthalmos and no enlarged thyroid to aid the diagnosis, but the presence of tachycardia, of tremors and of nervousness justifies one in diagnosing, according to inclination, larval Graves's disease or a neurotic condition, with, as Sir Clifford Allbutt puts it, "diffuse assemblage of mere accelerations."

And this brings me finally to what I think may legitimately be called "soldier's heart." I premise as the patient a man who really has been a soldier and exposed to the vicissitudes of warfare. Is the influence of warfare physical strain, toxin or psychic trauma? The factor of strain I have done my best to eliminate. A few words will deal with the other possibilities that have been raised. The patient presents symptoms generally of dyspnœa, always of fatigue on slight exertion, lassitude, persistent tachycardia without cardiac enlargement and perhaps a variable number of neurotic manifestations.

There is invariably a history of psychic trauma — it may be one

acute occasion or a long-continued bombardment by greater or smaller shocks.

These are the cases for exhaustive investigation, for the detection of toxins, for the estimation of buffer salts, for the consideration of the balance of the ductless glands, for inquiry into the previous psychical history.

It is unsatisfactory to invoke toxæmia, for surely this factor can never be eliminated and must play a part more or less in the production of any morbid state. The system is probably in a condition of auto-intoxication whenever it falls a victim even to psychic disturbances.

In some of these cases the antecedent history clearly exhibits the presence of some infection, e.g., influenza, dysentery, or toxic state, e.g., constipation or some other cause of auto-intoxication. In other cases it does not.

As regards the ductless glands I do not see how it is possible to deny or to prove their influence in this condition. What is the effect of the secretions upon the emotions? What is the influence of the emotions upon their secretions? Suppose the psychic disturbance does lead to some alteration in the glands, to the production for example of hyperthyroidism. Are we to suppose that such alteration is the principal result of the shock and that treatment directed to the gland will relieve symptoms? I personally have never seen the slightest benefit derived from this or for that matter any other form of treatment. There is, it seems to me, a great deal to be said in favour of a purely nervous origin. In the first place, a very large proportion of sufferers are of a distinct type of mentality, men with shallow reservoirs of nervous energy; the neurasthenic soil in fact. I yield to nobody in my admiration of the spirit which has animated the majority of sufferers from "soldier's heart" and all other forms of war neurasthenia when I describe them in this way. The symptoms correspond to a failure in vasomotor and cardio-inhibitory control. The obstinate resistance to any form of treatment supports the idea of a nervous origin, a shock to the nerve centres which persists, who can say for how long? It is a very striking feature that men who sustain a definite somatic injury do not manifest "soldier's heart" nor any other presumably nervous symptoms. In these cases of injury the immunity of the nerve centres to shock may be explained by the dissipation of the shock elsewhere, as the delicate works of a watch are spared in an accident in which the glass is smashed. It may even be explained without detriment to the hypothesis of neurosis by the mere circumstance of an injury having occurred satisfying the subconscious with the realization of something definite and not presenting to it only the sensation of some vague disturbance the uncertainty of which prejudices recovery.

Reviewing with not unnatural pessimism the persistence of symptoms, one cannot help thinking that only termination of hostilities could cure these sufferers, in whom with the best intentions there must continue to run a subconscious current of defence-neurosis telling them that recovery means

a return to the hell from which they have escaped. Treatment of such cases appears to have the sole effect of perpetuating their neurosis by fixation of the attention, although whether immediate vigorous treatment of them as of purely neurotic origin would yield better results we here have no opportunity of observing, since the cases we see are, so to speak, chronics who are left *in statu quo* after a great deal of practically every form of therapy that has been recommended.

As we see them, at any rate such cases are of no further use for active service, but given sedentary work they continue on a very low level of activity with the tachycardia and other symptoms unrelieved, but, so far as we can see, executing very light duties with comparative cheerfulness and apparently without any ill effects.

BEARER WORK OF A FIELD AMBULANCE.

By CAPTAIN, R.A.M.C. (S.R.).

THE duties of the field ambulance bearers are to convey the sick and wounded from the regimental aid posts to the field ambulance headquarters.[1]

(1) *Investigation before taking over.*—Before going into a new part of the line, the officer in command of the bearers and the senior N.C.O.s should be thoroughly acquainted with the scheme of evacuation. The new area should be visited and studied; the visit to include the *advanced dressing stations*, *relay posts*, and all the regimental aid posts. Equally necessary is an investigation of the number of bearers employed, the means of evacuation, i.e., by bearers carrying, by light railway, horse and motor ambulance, also the equipment required, and the means of obtaining water. What has been learned will serve as a model on which to work, but the energetic bearer officer will usually find many opportunities to make improvements. It would be wise if he accompanied the regimental medical officers in their visits, as he may find that the incoming medical officers may wish to modify existing arrangements and to open up in new situations (perhaps farther on). Under such circumstances the regimental aid post can be chosen in conjunction with the regimental medical officer, thus ensuring that its situation is convenient, both for clearing from the front line and to the bearer posts.

(2) *Taking over.*—The details having been worked out beforehand, this should be carried out without unnecessary delay, the bearers (with required equipment) going to their allotted posts in relief of the outgoing unit.

On completion of relief a report to that effect should be at once rendered to the field ambulance headquarters. The brigade or brigades in the line should be notified that the X Field Ambulance has taken over, and map references given of the positions of the various aid posts, etc. It is well for the officer commanding bearers to make this report personally, as he will find it greatly to his advantage to be always in close touch with brigade headquarters. The map references of the various dressing stations and aid posts (including regimental) should be sent to field ambulance headquarters, together with notes of any other information which might be of value. This system of reporting to field ambulance headquarters (for

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[1] Under certain circumstances a whole field ambulance may be employed as a "bearer division," in which case the evacuations may be to another field ambulance, or to a special *collecting post*. In the following notes it is assumed that the field ambulance is divided into a "bearer division," and the tent division or headquarters constituting a collecting post.

A.D.M.S.) any information which might be of subsequent use should be continued during the whole occupation.

(3) *Evacuation from Regimental Aid Posts* (THROUGH BEARER RELAY POSTS) *to* ADVANCED DRESSING STATIONS.—This may be by stretcher or hand carriage, light railway, horse or motor ambulances. In all probability a combination of several of these methods will be required. Provision should be made to meet all emergencies, e.g., alternative lines and methods of evacuation should be known. At any moment the light railway may be smashed, a shell on the road may make it impossible for horse or motor ambulance, and during active operations the possible congestion of roads must not be overlooked.

The *first part* of the evacuation is almost certain to be by hand or stretcher carrying, in trenches or in the open (at times only by night). To obviate too long a carry, bearer relay posts should be established. These usually take the form of dug-outs or cellars and serve as quarters for the bearers.[1]

It is a very good plan indeed (if practicable) to have always a certain number of field ambulance bearers at the regimental aid posts. Provision is made to replace these bearers immediately a case is brought down by them from the regimental aid posts. In this way it is obvious that the regimental aid posts must be cleared, and thus is overcome one of the most difficult parts of the evacuation. Failure to establish properly this connexion with regimental aid posts may lead to congestion and even collapse of the whole system of clearing. It has the additional advantage that the regimental medical officer can always easily communicate with the field ambulance. Replacement of bearers is carried out at all relay posts, from regimental aid posts to the last bearer station; immediately a squad arrives with a case, another squad moves forward to take its place.

The *remaining part* of the evacuation to the advanced dressing station may be by light railway, horse ambulance or motor ambulance. It usually presents fewer difficulties. The chief point is to see that a constant and adequate supply of vehicles is maintained. The *wheeled stretcher* is of very great value. It can often be used on roads unsuited for horse and motor transport and saves a great amount of carrying.

(4) *Treatment of Patients at* BEARER POSTS.—This must necessarily vary a great deal with circumstances. But the essential point is so to attend to the patient as to enable him to bear the journey to field ambulance headquarters, where he can have more detailed attention. "The first duty of the bearers is the rapid transmission of the patients." Time spent in the elaborate treatment of one patient means delay in bringing in the next.

[1] The bearers should be encouraged to occupy themselves during periods of inactivity in improving and increasing the accommodation of such dug-outs. In fact the principle of repairing and strengthening and increasing accommodation should be general in all posts occupied by the field ambulance.

(5) *Evacuation from* ADVANCED DRESSING STATIONS *to Field Ambulance Headquarters.*—This is usually by car and as a rule gives little trouble. The bearer posts should be kept as clear as possible. The commanding officer of the bearers should, as already mentioned, not overlook the possibility of delay from road congestion and should, if possible, have an alternative route.

(6) *Accommodation at Aid Posts, etc.*—This must be provided not only for the patients but also for the bearers. If bearers are to work hard it is essential that they should have comfortable and as far as possible safe resting quarters. These they can construct themselves, and after a time they become quite skilled in the making of dug-outs, etc. The Royal Engineers should be troubled as little as possible, as they are usually quite fully employed when in the line. As already mentioned, this principle of strengthening existing and constructing new dug-outs should always occupy slack times. There is little fear of having too much accommodation.

(7) *Relief of Bearers and Bearer Reserve.*—In ordinary slack times this is not of very much importance, as the amount of work to be done is not very great. Bearers obtain their usual rest, and a relief once a week or at longer intervals should be found ample. But in busy times when bearers have to carry for many hours at a stretch, some other system of relief is necessary. Over a long strenuous time it is a good plan to have always one-third of the available bearers in reserve at (?) headquarters. There they will usually be able to rest in comfort. Of the remaining two-thirds, one half can be relieved daily by the headquarters reserve. In this way the bearers will have forty-eight hours at the advanced posts, followed by twenty-four hours rest at headquarters. This system of relief should also apply to the bearer officers, with the exception of the officer in charge, who should remain during the occupation.

(8) *Relationship between Officer Commanding Bearers and Regimental Medical Officers.*—The officer in command of the bearers should know all the regimental medical officers personally and should set out with the intention of being their best friend. The regimental medical officer has many hard and trying times, his requirements and needs will be many and it is to the bearer officer he will come for help. At any time he may call for dressings, blankets, etc. The officer in command of bearers must be ready to supply these at once—the need may be urgent—instead of having to send back to headquarters for them, thus causing unnecessary delay. For this purpose a sufficient stock of likely requirements should be kept at the *bearer posts.* The chief of these, of course, are dressings, stretchers and blankets.

(9) *Officer in Command of Bearers.*—As bearer work constitutes one of the most difficult links in the whole scheme of evacuation, the officer in command should be capable, energetic, and a very hard worker. His duties will be many and varied, and he must be ready at all times to tackle problems of very diverse nature. His time should not be spent in dressing

cases or conducting bearer parties—such being the duties of the officers under his command. He will be fully occupied in supervising the work, keeping in touch with the regimental medical officer and his own headquarters, speeding up evacuations, and remedying at once any delays in the route.

(10) *Hints to Officer in Command of Bearers.*—Supervise all things personally; it is easier and much more satisfactory than delegating duties and receiving reports. Always make arrangements to deal with more casualties than are expected.

Give most attention to the clearing of the most forward area. As it is easier to clear from the bearer posts to field ambulance headquarters, than from regimental aid posts to bearer posts, concentrate on the latter, the former will almost look after itself.

Provide food and hot drinks at as many of the aid posts as possible, but watch that this does not cause unnecessary delay in evacuation.

Deal promptly with all indents received from regimental medical officers, and be personally responsible for the quick delivery of requirements.

If a chaplain arrives at the bearer post, offer him a job[1] to do. In addition to his own duties, *he will be glad to give assistance and usually does it well.*

[1] e.g., giving hot drinks to the wounded.

Clinical and other Notes.

A SYRINGE CAPABLE OF BEING USED FOR MULTIPLE PURPOSES.

By Lieutenant J. P. McGOWAN.
Royal Army Medical Corps.

The syringe consists of a barrel with lateral openings, a plunger with a longitudinal groove and a mechanism for the interaction of these parts.

In fig. 1, A, B, C, D, E, F, is the barrel closed at the end, C, D, and open at the end A, F, with lateral openings, to serve as inlets or outlets, surmounted by comparatively long studs at several points on one circumference, such as B, G, and E. These lateral openings should not be too numerous and should probably be restricted, in the case of a cylinder of the diameter used in ordinary syringes, to four at a quadrant's distance from one another.

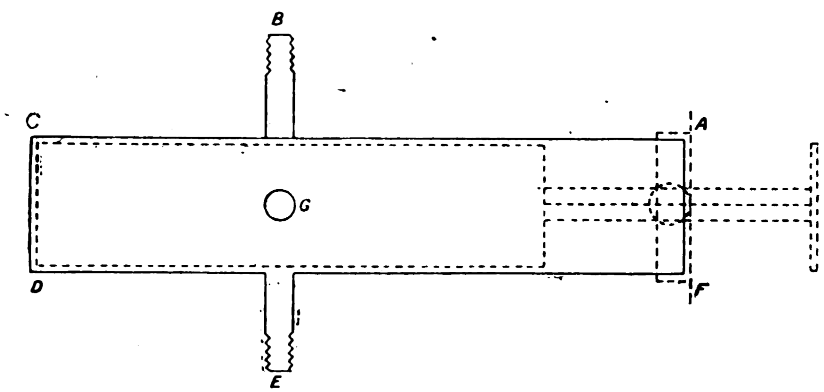


Fig. 1.

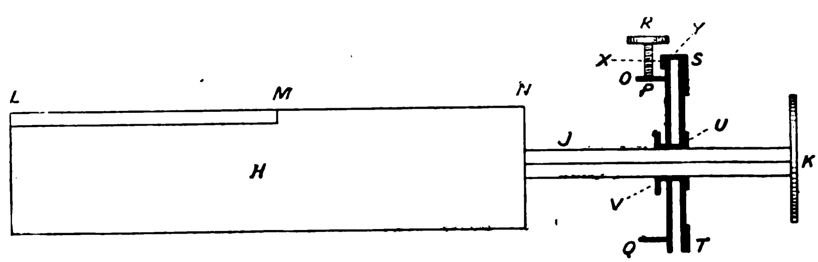


Fig. 2.

In fig. 2, H, J, K, is the piston of which H represents the head, J is the stem, square in section, and K the handle or button head. L, M, is a longitudinal groove cut into the solid piston head, while the part M, N, of the piston head is solid, and may or may not have a piston ring on it. The piston is accurately ground into the barrel.

O, P, Q (fig. 2), is the screw-on cover of the syringe, which is fitted on to the barrel at A, F, and fixed in one definite position by means of the fixation screw R. This screw cover has a circular hole in its centre through which passes a cylindrical projection U from a circular plate S, T. This cylindrical projection has a flange V, on its inner surface, which holds the plate S, T and the cover together, though allowing a circular movement of the plate S, T. The square piston stem J passes through a square opening in the cylindrical projection U, and is a fairly tight fit allowing of easy longitudinal movement but of no circular movement.

On the projecting rim of the cover X are cut shallow notches to correspond exactly with the various lateral openings in the barrel. Further, at a point on the rim of the plate S, T, corresponding exactly with the situation of the longitudinal groove L, M, in the piston head is fixed, in a line with the axis of the syringe, a stout straight spring with a wedge-shaped head Y. The function of the notches on the cover rim and this spring on the plate S, T, is to ensure that the groove on the piston head is in accurate communication for the time being with any lateral opening desired.

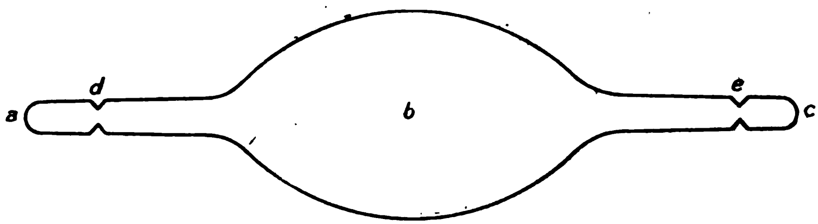


Fig. 3.

In the working of the syringe, suppose that the piston is pushed fully in and that its groove is opposite an inlet. On pulling out the piston in this position, fluid comes in at the inlet along the groove and fills the barrel. The other lateral openings in the barrel are shut off meantime by the convexity of the piston head. When the syringe is filled the piston is turned round until the groove is opposite the outlet desired, while the inlet is at the same time automatically shut off. The piston is now pushed home and the fluid flows from the syringe along the groove and out by the outlet. After this, the piston is rotated back so that the groove is again opposite the inlet when the process described can be repeated indefinitely.

The outlets and inlets are connected up to the needles and reservoirs respectively by means of rubber tubing. A special case, however, deserves mention, namely, where the fluid to be injected, such as antitoxic serum, is contained in a capsule. Here it is desirable that the capsule should be of a special shape as shown in fig. 3, where *a*, *b*, *c* is a bulb drawn out at both ends into narrow tubes with depressions and file marks at two points *d* and *e*.

On the inlet stud of the syringe is fitted a short length (about one inch) of very thick walled narrow bored rubber tubing. The fluid in the capsule is now shaken down to one end and the capsule held in a vertical position. The narrow tube at the upper end of the capsule is now broken at the file mark and the end sterilized

by the means of a flame. The conical end left by the breaking off at the middle of the depression renders easy the fitting of this end into the rubber receptacle, just mentioned, on the syringe. For this purpose the syringe is held with the rubber fitting downwards and this latter is then squeezed on to the broken-off end of capsule. When this is accomplished the syringe is turned bodily round so that the capsule is now inverted when its other end is broken off at the file mark and the pumping of its contents can be commenced.

The syringe can be made entirely of metal, or better, of glass, or silica ware, with metal fittings. In the case of an all-metal syringe the graduations would be on the stem whilst in one with a glass barrel they would be on the barrel. The size of the syringe need not be large, depending entirely on the amount that it is desired to deliver with one stroke of the piston. Speaking generally, it need not be larger than a five cubic centimetres or ten cubic centimetres record syringe. The holes in the studs as well as the groove in the piston should be fairly large, especially in consideration of the use of the apparatus as an aspirator. On the end C, D (fig. 1), of the barrel may be fitted an additional nozzle controlled by a tap or there may be placed here a fitting for the reception of a suitable handle to manipulate the apparatus while it is being used.

Some of the uses to which the syringe can be put may be indicated. Thus it may be used as an aspirator, to remove collections of fluid from various parts of the body, for the intravenous injection of salvarsan, as an infusion or transfusion appliance, as also for the administration of successive measured doses of drugs to a series of men as in the administration of morphia or of typhoid vaccine. It may also be used for the measuring out of successive measured doses of medicinal substances into ampoules, more especially when this has to be accomplished in an aseptic manner. It can also be used as a simple syringe if it be fitted with the nozzle controlled with a tap at the end C, D, as mentioned above. The drawings illustrating this description are by Serjt. James Read, R.A.M.C., T.F., to whom I wish to express my thanks.

I am indebted to Lieutenant-Colonel D. J. Graham, R.A.M.C., T.F., for permission to publish this note.

AN APPARATUS FOR WITHDRAWING BLOOD, ETC., FOR CULTURES, WASSERMANN REACTION, ETC.

By Lieutenant J. P. McGOWAN.
Royal Army Medical Corps.

This apparatus is constructed from a test-tube of suitable size, a cork to fit it, a piece of small-bored glass tubing, a piece of Carrel tubing, a large sized record needle, a piece of bandage and some cotton-wool and thread. A cork (e.g., a medicine bottle cork) to fit the test-tube selected has a narrow longitudinal groove cut in its circumference to allow of the escape of air from the interior of the test-tube. Through a hole bored in the centre of the cork is passed a piece of glass tubing about $\frac{1}{8}$-inch diameter and about three inches long. Round the edge of this glass tubing which is to project into the test-tube is wrapped cotton-wool of sufficient quantity to form a plug for the test-tube when the cork is withdrawn.

On the other end of the glass tubing is fitted a piece of Carrel tubing about six inches in length carrying a large sized record needle at its end. The cork so prepared is fitted into the test-tube and tied in by means of thread round the rim of the test-tube and over the end of the cork. After this, four turns of a loose wove three-inch bandage are taken round the upper edge of the test-tube just beneath the rim. The record needle is now bent over and bound to the side of the test-tube by several additional turns of the bandage, which is then split at the end and tied in a single knot. A cowl of oiled paper is then put over the top of the test-tube to include everything down to the bottom of the bandage, where the paper is now securely fastened with a piece of string. A few pricks are now made on the paper with a needle to allow of the escape of steam and the entrance of air.

The apparatus is now sterilized as a whole by pressure steam in the autoclave. After sterilization, in order to prevent rusting of the needle, if the apparatus is kept some time before use, it is dried rapidly in a hot air chamber or by placing it near a fire.

The test-tube may be used empty or may have a sufficiency of any suitable culture medium placed in it before sterilization.

In using it the cowl of paper is removed, the bandage is loosened and the turns unwound until the needle is exposed. The Carrel tubing is now grasped near the point where it is attached to the record needle and the apparatus is then suspended from this point when the remaining turns of the bandage are removed. The needle is now inserted into the vein, when blood can be drawn into the test-tube in any required quantity. The needle is then withdrawn from the vein and, after cutting the thread which holds the cork in the test-tube, the cork with its appendages is bodily removed from the test-tube. The cotton-wool plug is, however, left in the test-tube and the hole in its centre is immediately closed with a pair of sterile forceps and the plug otherwise adjusted. The test-tube may now be incubated or otherwise dealt with as the occasion demands.

The needle and glass tubing are immediately cleaned out and, together with the cork and a fresh piece of Carrel tubing, are fitted up in a fresh test-tube and sterilized to be ready for use on a future occasion. With the exception of the rubber tubing the materials employed may be used over and over again if precautions as to cleaning and drying the apparatus are carefully observed.

I am indebted to Lieutenant-Colonel D. J. Graham, R.A.M.C., T.F., officer commanding the hospital, for permission to publish this note.

STERILIZER FOR DRESSINGS, &c.

By Captain J. CRAWFORD.

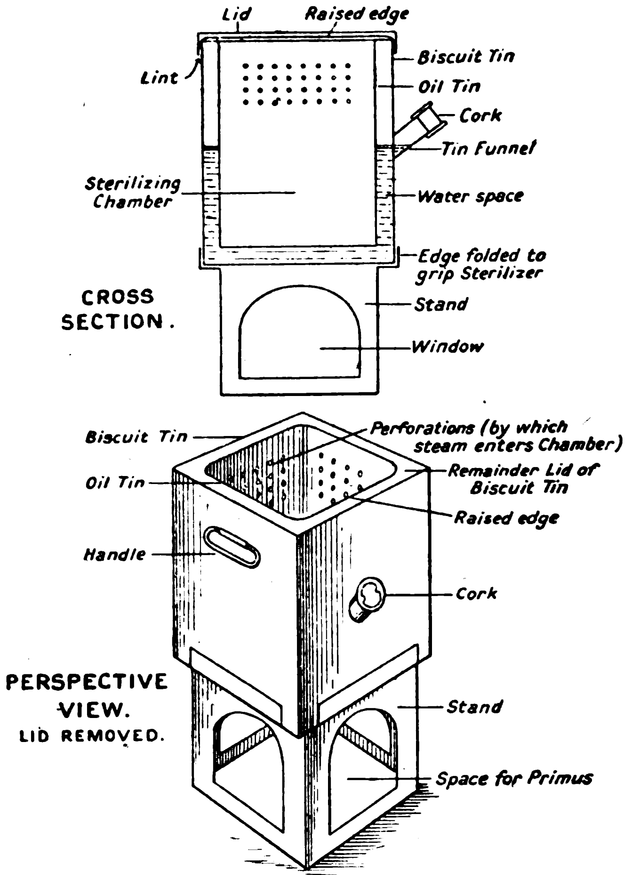
Royal Army Medical Corps.

Below is a description of a sterilizer for dressings, etc., made for me by Staff-Serjt. Atchinson, It would appear to be of value for field ambulance and regimental work.

Things required : One biscuit tin ; one four-gallon oil tin ; one good cork, from empty pickle bottle or tablet bottle ; one lid of N.C.T. charge box (to be obtained from any battery). Soldering iron, soft solder and flux (ac. hydr. chlor.)

The lid of the oil tin is removed, and small holes are pierced in the sides in rows, the lowest row being about five inches from the top.

The lid of the biscuit tin is cut out, but sufficient is left round the edge to allow of soldering to the four-gallon oil tin, when that is finally placed inside. A small disc is cut out of the side of the biscuit tin, below perforation in oil tin, and a funnel of tin, made to fit accurately the cork selected, is soldered in at an angle of 45° upwards from biscuit tin.



Sketch of sterilizer.

The four-gallon tin is now placed inside the biscuit tin, and the top edge (left about $\frac{1}{8}$ inch higher than the biscuit tin for purpose of better sealing) soldered to remainder of lid of biscuit tin. It will be found that a space of half inch approximately now exists between the two tins on the sides and bottom. The lid is made with a phlange of $\frac{1}{2}$ inch to 1 inch to allow of better fitting. For convenience, wire handles should be fixed to sides of outer tin. If desired, a stand may be made out of a four-gallon oil tin, by cutting out top and bottom and side windows, and bending the top two inches, as shown in sketch.

In use, the dressings are put into the chamber, the lid is put on tightly over one or two layers of hospital lint. About $1\frac{1}{4}$ pints of hot water is then poured into funnel, and cork applied if necessary, a piece of jaconet over cork will render the plug steam-tight. The whole is then put over a primus.

The apparatus was tested by the officer commanding 13 Mobile Laboratory.

At eight minutes after water boiled the thermometer registered 98° C. in the centre of a pile of dressings. The thermometer was not a "maximum" one, and was falling when seen; a pressure gauge has been fitted and registered one pound pressure, so probably temperature reaches over 100° C.

It is thought that higher temperatures might be gained by strengthening the boxes by wire, and clamping the lid.

THE EFFECTS OF LONG CONTINUED DOSAGE WITH QUININE ON THE VISUAL APPARATUS.

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AND

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Ophthalmologist, 4th London General Hospital.

The arrival in this country of many cases of chronic malaria, most of whom have been under treatment with considerable doses of quinine for prolonged periods, seemed to us to offer an opportunity of studying the effects of quinine on the visual apparatus.

Commenced by one of us more than a year ago, these investigations were at first confined to malarial patients who were sent to the ophthalmic department complaining of symptoms thought to be of ocular origin. Ever increasing pressure of work caused the suspension of the inquiry for a time, but later it became possible to resume it on a larger scale with more method and precision. *The method of examination adopted* was to take the field of vision on admission and again at such intervals as were thought desirable. This was done with a McHardy's perimeter using a five millimetre disc, and as far as possible at the same time of day and under the same conditions of light. When the patient had been in the habit of using correcting glasses he wore them when his fields of vision were taken. The visual fields were investigated for central scotomata by James's cards; for central colour scotomata by coloured discs of three to five millimetres; and the colour vision by the wool test, confirmed when any doubt existed by Edridge Green's bead test. The refraction was then estimated under a mydriatic, and careful examination of the fundi was made through the dilated pupils.

In describing the fields of vision we have found it convenient to divide them arbitrarily into:—

(*a*) ***Full fields***, where the field is either normal, or concentrically contracted to not less than 70° on the temporal side, or not less than 50° on the nasal side.

(*b*) ***Medium fields***, where the field is contracted to 70° but not less than 20° on the temporal side, and to 50° but not less than 20° on the nasal side.

(*c*) *Small fields* where the field is concentrically contracted to 20° or less.

We have examined in all 170 cases of chronic malaria, who have been under treatment with quinine, in varying doses for varying periods of time.

Of these 145 had further quinine treatment after admission to this hospital, and 25 had no more quinine.

Of the 145 who had further quinine treatment, 94 had full fields of vision on admission; 32 had medium fields of vision on admission; 19 had small fields of vision on admission.

After further quinine treatment: 66 showed an increase in the field of vision; 68 showed no change in the field of vision; 11 showed a decrease in the field of vision.

Of the 25 who had no further quinine treatment: 9 showed an increase in the field of vision; 16 showed no change in the field of vision whilst under observation. It was impossible to get a perfectly accurate account of the amount of quinine taken previous to admission here, and we had to rely on the patients' own statements, of which the following are typical of each class.

Cases showing Full Fields of Vision on Admission: (*a*) had taken at least 10 grains of quinine every day from September, 1916, to July, 1918, with larger doses whilst in hospital; (*b*) 10 grains of quinine daily from June, 1916 to July, 1918; (*c*) 10 grains of quinine daily from September, 1916 to July, 1918; (*d*) an average of 10 grains of quinine daily from August, 1916 to June, 1918; (*e*) 10 grains of quinine daily, with larger doses whilst in hospital from August, 1916 to June, 1918; (*f*) 10 grains of quinine daily, with larger doses whilst in hospital on six occasions from May, 1916 to June, 1918.

Cases showing Medium Fields of Vision on Admission: (*a*) 15 to 30 grains of quinine daily by mouth, with occasional intramuscular injections in addition, from November, 1917 to May, 1918; (*b*) 10 to 35 grains of quinine daily from October, 1917 to May, 1918; (*c*) on an average 20 grains of quinine daily from August, 1917 to May, 1918; (*d*) 10 grains of quinine daily, with larger doses whilst in hospital from March, 1916 to April, 1918; (*e*) 5 grains of quinine daily with larger doses whilst in hospital from October, 1917 to May, 1918; (*f*) 10 grains of quinine daily, with larger doses whilst in hospital from July, 1916 to May, 1918.

Cases showing Small Fields of Vision on Admission: (*a*) 30 grains of quinine daily whilst in hospital on four occasions; (*b*) 10 grains of quinine daily for past two years, increased to 45 grains daily whilst in hospital; (*c*) 30 grains quinine daily for eighteen days, 20 grains daily for one hundred and fourteen days, and 10 grains daily for thirty-five days; (*d*) 10 to 40 grains of quinine daily at irregular intervals for eleven years; (*e*) 5 grains of quinine daily fairly regularly, from December, 1915 to April, 1918, with bigger doses when in hospital; (*f*) an average of 10 grains of quinine daily for two and a half years.

Taking the *various preparations of quinine used* in treating the cases in question whilst they were in this hospital, we find that of 30 cases who were given *quinine sulphate* in doses of 10 grains three times a day, by the mouth: 19 showed an increased field of vision at the end of treatment; 10 showed no change in the field of vision; 1 showed a decrease in the field of vision.

Of 72 cases treated with *quinine hydrochloride* in doses varying from 10 to 15 grains three times a day, by the mouth: 30 showed an increased field of

vision; 34 showed no change in the field of vision; 8 showed a decrease in the field of vision.

Of 10 cases treated with *quinodin* in doses of 5 grains three times a day, by the mouth: 3 showed an increased field of vision; 7 showed no change.

Of 3 cases treated with *euquinine* in doses of 10 to 15 grains three times a day: 3 showed an increased field of vision.

Of 5 cases treated with *quinine hydrochloride, in a single dose of* 60 *grains, by the mouth:* 1 case showed an increased field of vision; 4 cases showed no change in the field of vision.

One case treated with *intramuscular injections of* 30 *grains of quinine bihydrochloride, and* 30 *grains of quinine hydrochloride, by the mouth* daily, for four consecutive days, showed a decrease of the field of vision of less than 10°.

Of 5 cases treated with *one subcutaneous injection of* 45 *grains of quinine alkaloid in an oily menstrum:* 2 showed an increased field of vision; 3 showed no change in the field of vision.

Of 3 cases treated with *two subcutaneons injections of* 45 *grains of quinine alkaloid at an interval of four days:* three showed no change in the field of vision.

One case treated with 90 *grains of quinine sulphate* by the mouth daily for three successive days showed no change in the field of vision.

Ten cases were treated with *quinine hydrochloride* 90 *grains daily by the mouth, for three successive days.* Unfortunately, their fields of vision were not taken before the beginning of treatment, but immediately treatment was stopped 1 showed a full field of vision; 5 a medium field, and 4 a small field. Kept under observation for periods up to a month after treatment, 8 showed an increase in the fields of vision, whilst 2 remained stationary.

Of 4 cases treated with *quinine hydrochloride* 90 *grains daily* for three successive days, 1 showed a decrease in the field of vision, whilst that of the 3 others remained stationary.

One case treated with *subcutaneous injections of quinine urea hydrochloride*, 15 grains, 30 grains, and 30 grains on three successive days, showed a slight increase in the field of vision.

Of the 10 *cases which showed a decrease in the field of vision*, whilst under further quinine treatment in the 4th London General Hospital:—

Case 1 had taken 10 to 35 grains of quinine daily, for seven months before admission. In this hospital he was given 10 grains quinine hydrochloride twice a day for thirteen days, followed by 10 grains once daily for thirteen days.

Case 2 had taken 5 grains of quinine daily for seven months before admission. In this hospital he had 45 grains of quinine hydrochloride daily for seven weeks, followed by 60 grains daily for two weeks, and that by 30 grains daily for twenty-six days.

Case 3 had taken 10 grains daily before admission. In this hospital he was given 30 grains of quinine hydrochloride daily for seven days, followed by 10 grains daily for seven days.

Case 4 had taken 20 grains daily for twenty-seven months before admission. In this hospital he had 30 grains of quinine hydrochloride daily for eighteen days.

Case 5 had taken 5 grains daily for five and a half months before admission. In this hospital he was given 45 grains of quinine hydrochloride daily for twenty-three days.

Case 6 could give no record of the amount of quinine taken before admission. In this hospital he had 30 grains quinine hydrochloride daily for fourteen days.

Case 7 had taken 20 grains of quinine daily for eight months before admission. In this hospital he had 30 grains quinine hydrochloride daily for twenty days.

Case 8 had taken 5 grains of quinine daily for six months, followed by 10 to 45 grains daily for four months. In this hospital he was given 30 grains of quinine hydrochloride by the mouth, with 30 grains of quinine bihydrochloride by intramuscular injection daily for four days.

Case 9 could give no account of the amount of quinine taken before admission. In this hospital he had 30 grains of quinine sulphate daily for twenty-one days.

Case 10 had taken 10 grains of quinine daily from September to December, 1917, followed by larger doses, and intramuscular injections. In this hospital he had 15 grains of quinine hydrochloride three times a day, for four days, followed by intramuscular injections of quinine bihydrochloride 15 grains daily for twelve days.

In three of the above cases the contraction of the field of vision was less than 10°, in three cases 10°, in two cases 20°, and in two cases 30°.

Case 11 had taken at least 10 grains of quinine daily, from October, 1915, to May, 1916, with larger doses whilst in hospital. Here he was put on 90 grains quinine hydrochloride daily, but when he had taken 150 grains he complained of dimness of vision. The quinine was stopped. Opthalmoscopic examination eight hours later showed nothing abnormal in the fundus. The dimness cleared up in two days, and then his field of vision was found to have contracted concentrically from a full field to less than 10°. Four days later, i.e., six days after the quinine was stopped, his optic discs were noticed to be pale and his retinal vessels contracted. Seven weeks later his fields of vision had expanded very slightly, and his visual acuity improved from $\frac{6}{18}$ in each eye to $\frac{6}{12}$ in each eye. His case is complicated by the fact that he had injections of soamin in East Africa, and that he is a heavy smoker, consuming on an average seven ounces of tobacco a week. An interesting point about him is, that his fundi appeared perfectly normal eight hours after the quinine was stopped, and that no change was detected till six days later.

To study the *effect of quinine on the fields of vision of men, who had never suffered from malaria, and who had never previously taken quinine*, five men with full fields of vision were selected.

Of these, three were given 90 grains of quinine hydrochloride daily by the mouth, for three successive days. Their fields of vision taken before the quinine was given, and at intervals up to a week after the quinine was stopped, showed no change whatever, nor could any changes be detected in their fundi.

One man was given an intramuscular injection of 15 grains of quinine bihydrochloride daily for fifteen days with no effect on his field of vision, nor on his fundi.

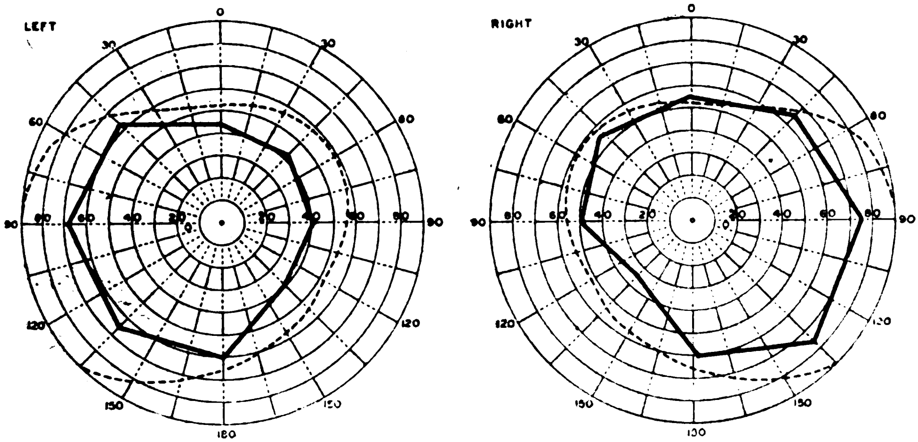
One man was given 10 grains of quinine sulphate by the mouth, three times a day for a month. At the end of the treatment his fields of vision and fundi were perfectly normal.

Neither the number of malarial parasites in the blood, nor the degree of anæmia present, in the cases we examined, bore any constant relation to the fields of vision.

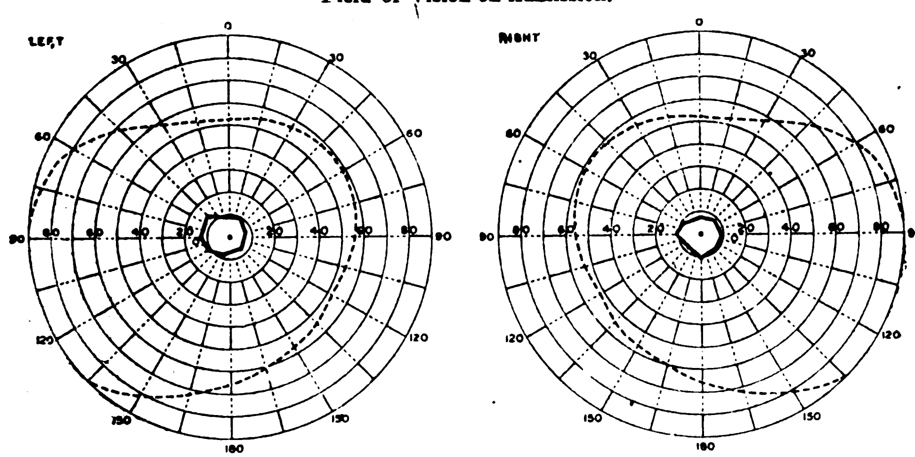
Ophthalmoscopic examinations of the fundus of 106 of the above cases showed perfectly normal fundi in ninety-five. The colour vision was normal in all, and none of them showed any central scotoma or central scotoma for colour.

Eleven cases showed abnormalities as follows: 4 apparently slightly contracted retinal vessels; 2 apparently slightly contracted retinal vessels and pale discs; 1 pale discs; 2 old hæmorrhages; 2 typical malarial retinitis.

One case reported that he was blind for fourteen days whilst in hospital at Salonika, where he was treated with 45 to 60 grains of quinine daily, in June, 1916. On examination here in October, 1917, his fundi were found to be perfectly normal with R. V. $\frac{6}{6}$ and L. V. $\frac{6}{6}$.



Field of Vision on Admission.

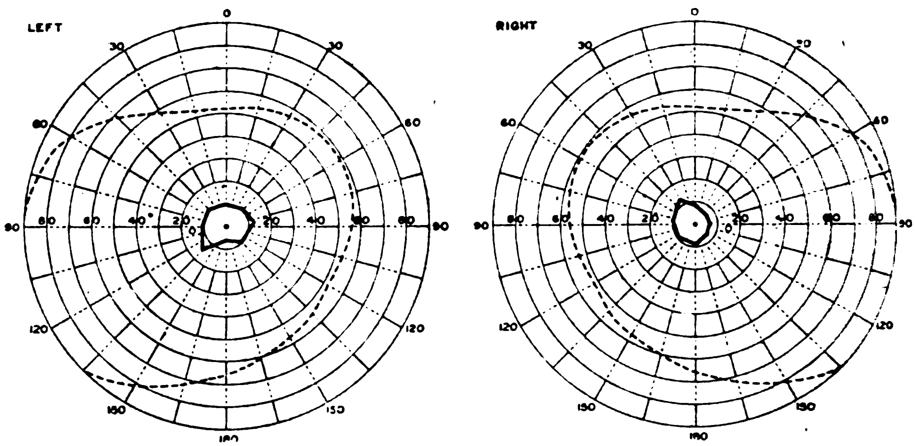


Field of Vision after taking Quinine Hydrochloride, 150 grains, in thirty-eight hours.

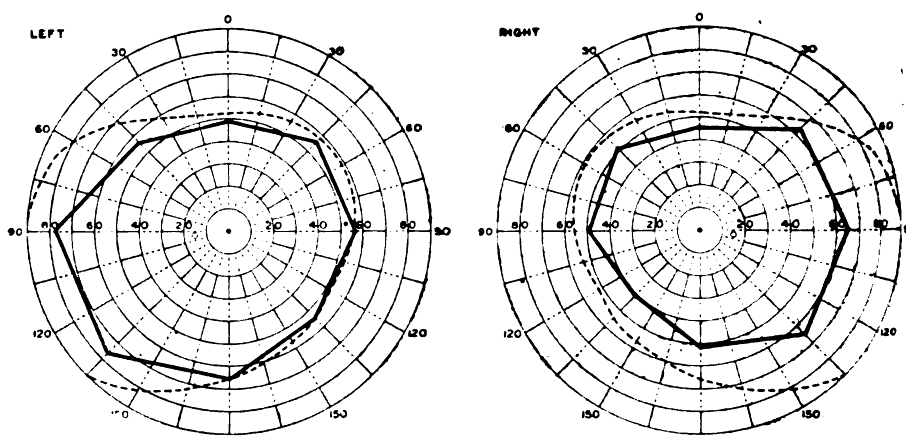
One case who was said to have been unconscious with cerebral malaria in June, 1917, and was treated with intramuscular injections of quinine, was diagnosed as a case of quinine amaurosis in Malta, where his R. V. was found to be $\frac{6}{18}$ and his L. V. $\frac{6}{24}$. At the 4th London General Hospital, in February, 1918, his R. V. was $\frac{6}{9}$, improved with glasses to $\frac{6}{6}$, and his L. V. $\frac{6}{12}$, improved with

glasses to $\frac{6}{5}$. His fundi were normal. There were no central scotomata, and his fields of vision were medium.

Long continued treatment with quinine apparently has some effect in contracting the fields of vision, for twenty-two per cent of our cases showed medium fields, and thirteen per cent small fields. An improvement in the fields of vision of those who had no further quinine treatment was to be expected, but it is surprising to find that under further quinine treatment forty-five per cent should show an increase in the field of vision, and only eight per cent a decrease.



Field of Vision on Completion of a Course of Quinine Hydrochloride, 20 grains daily for three successive days.



Field of Vision thirty-eight days after Completion of a Course of Quinine Hydrochloride, 90 grains daily for three successive days.

In none of the cases with the most restricted fields of vision on admission could any change be detected in the retina, or optic discs, and the men were unconscious of the restriction, and maintained that their eyesight was as good as ever it was.

That some individuals are specially susceptible to the action of quinine on their eyes is established by the number of cases of quinine amaurosis recorded, but the proportion must be small, for of 1,296 cases admitted to this hospital in the last seven months, only one has complained of any diminution of visual acuity as the result of taking quinine, and his case was complicated by the fact that he had been given injections of soamin, and was a heavy smoker.

Our experimental cases are few in number, but tend to show that in normal healthy men, large doses up to 90 grains of quinine hydrochloride daily for three days have not even a temporary effect on the fields of vision. Their fundi and fields of vision remained perfectly normal as did those of the men who were treated with single doses of 60 grains.

We are acquainted with the classical teaching, as to the danger to the visual apparatus of even small doses of quinine, but our investigations lead us to believe that no one need be deterred from giving moderate doses—10 to 15 grains three times a day—of any of the preparations of quinine we have used, by the fear of causing permanent damage to the eyes. Also that when the visual field is found to be contracted, either immediately on completion of a course of quinine or during its progress, the prognosis is good, and ultimate expansion of the fields of vision may be expected.

Charts illustrating some of the conditions and changes in the visual fields are shown on pp. 299 and 300.

We are indebted to Colonel Sir Nestor Tirard, Officer Commanding 4th London General Hospital, and to Colonel Sir Ronald Ross, Consultant in Malaria, for permission to publish these notes.

CHRONIC SUPPURATIVE OTITIS MEDIA IN THE NEW ARMY. A PLEA FOR TREATMENT IN ITS EARLIEST STAGES.

By Captain H. SMURTHWAITE.
Royal Army Medical Corps.

Perhaps we are in a better position at the present time to study the ravages of chronic ear suppuration in the nation than in any period of history, from the fact that a man's physical defects are now brought into clear daylight from the absolute necessity of his physical fitness as a fighting entity. After all it is mostly from this point of view that a man is regarded to-day, whether he is Category A, B or C.

Out of 5,000 cases which have been sent to the throat, nose and ear department of the Military Hospital, Tidworth, for treatment and categorizing during the year ending October 31st last, no fewer than 890 were suffering from chronic suppurative ear disease—practically a battalion—the period of their disability ranging from a few months to many years, or in the patient's words, "as long as I can remember." A large majority of these cases are only fit for Category C, whatever some people may say to the contrary. They all suffer from deafness and are not fit for the firing line; most of them are in very indifferent health, are anæmic from prolonged suppuration and are consequently a fitting soil for every microbic disease. A large number are most of their time in their medical officer's hands for

treatment, a treatment of syringing and drops, which after all is only marking time, for little short of the mastoid operation will cure the majority of these cases, and, as we know, space and time will not permit this.

The greatest number of these cases, if not all, would have been A men to-day, as far as their ears are concerned, had systematic and energetic treatment been carried out in the earliest days of the onset of the disease.

These numbers could be enormously reduced if we adopted systematic prophylactic methods and did not wait till the disease was far advanced.

Every fever hospital should have an otologist attached, or at least a medical officer in charge who has a fair knowledge of the dangers of ear disease, and who would always be on the alert for its early onset, for these institutions are a fruitful nest for such cases, and many a patient leaves the institution with an ear discharge, not only a danger to himself, but to other children with whom he or she comes in contact, for they thus still carry the seeds of the specific fever about with them.

It is in the earliest stages of any disease that we have the opportunity and greatest chance of permanent cure, and this applies in the highest degree to the disease I am reviewing. I have invariably admitted into hospital every case of acute otitis media, and every case of suppurating ear when the disease has run less than two months, with the certainty of effecting a cure by careful and energetic treatment. Speaking generally, cases beyond this period cannot be so favourably regarded, also there are too many of these to be treated as in-patients, and in the majority of them permanent damage, more or less, has already been done to the structures in the middle ear, with consequent loss in the hearing power.

One naturally selects those cases which have a reasonable chance of cure. One *must* make room for the dangerous ones in which a mastoid operation is imperative.

During the last year there have been fifty-four cases of acute or sub-acute otitis media, all of whom have left hospital with all discharge ceased, the rent in the drum healed and the hearing restored.

One's whole object is to gain at once the upper hand in these cases in the early stage, to nip the disease in the bud and to restore the middle ear to a healthy state, before serious changes take place, such as involvement of the antrum and mastoid cells, lateral sinus or meninges. Even should the patient escape these, there is always, if the suppuration continue for an extended time and finally dry up with the perforation in the drum healed, marked fibrous tissue formation of the lining membrane of the middle ear, which must impair the hearing, varying from absolute deafness to loss of the acuteness of hearing. I am seeing daily such cases, in which the patient has come on account of deafness in one or other ear. One can note the site of a former perforation in the drum now healed, by a calcareous deposit or scar tissue, indicating that the patient has had a long-standing ear discharge some time previously. In fact you can, as a rule, get from the patient a history of former suppuration. In these cases permanent changes have taken place in the middle ear, interfering with the normal conduction of sound waves, and alas, in many of these cases we can do little or nothing to restore the hearing.

Is it to be wondered at that the hearing becomes permanently affected if the

disease is allowed to persist for any length of time? The finer the adjustment of any machine, the more readily is it thrown out of gear by lack of attention and wrong treatment. Among the poor there is the greatest lack of attention to the ears.

Dr. Mygind, of Copenhagen, in his work on "Deaf-mutism and how to prevent it," says: "Every otologist has seen striking examples of the want of attention paid to ear disease in children, and many children are admitted into deaf and dumb institutions with ear disease which have never been submitted to medical examination, not to mention treatment. This is especially the case with suppuration of the middle ear, which, either resulting from the acute infectious diseases or from other cause, is frequently considered rather as a natural remedy than as a disease which calls for treatment. It is to be hoped that the recognition which is by degrees, though slowly, being yielded to otology by the medical profession will make itself felt in the prevention of deaf-mutism by opening the eyes of the practitioner to the importance of ear diseases and their treatment, and also that the general public may be led to form other opinions upon the subject than those now prevalent."

The above was written some few years ago and does not now apply so forcibly; but still there is ample room for improvement.

The pathology of acute middle-ear disease is similar to that of all other mucous membranes: dilation of the vessels with swelling and lessening the lumen of the cavity. The starting point is invariably the posterior nares and oftener than not follows the acute febrile diseases—scarlet fever, measles, mumps, influenza, etc. Among the predisposing causes the most important are adenoids, enlarged tonsils and nasal disease.

Any inflammation or catarrhal condition in the neighbourhood of the Eustachian tube easily spreads up the tube to the middle ear, for their lining membranes are contiguous. Should the thickness of its lining membrane become increased by inflammation, its walls soon come together and block the lumen. The middle ear then becomes an enclosed cavity with no outlet for the serous fluid thrown out by the engorged vessels. The patient then experiences fullness in the ear accompanied by deafness. Should the drum be examined it will be seen that the drum membrane has lost its lustre and in all probability is indrawn, for part of the air in the middle ear has been absorbed and the external air pressure is greater than that within, consequently the drum is forced inwards. If there is a big amount of fluid in the middle ear, there will be bulging in the posterior quadrant of the drum, and should the dam in the Eustachian tube be allowed to continue many things may happen; the inflammation may slowly resolve of its own accord, but oftener than not it does not, and unless a knife is put into the bulging membrane and politzerization carried out, the serous exudation in the middle ear becomes septic, followed by abscess formation. The drum becomes intensely red and bulging, with great pain to the patient, until he is relieved by the abscess bursting into the external auditory canal, leaving a small jagged opening in the membrane. In some of these cases following the acute infectious diseases, such as scarlet fever, the inflammation spreads so rapidly, due to the virulence of the micro-organism, that the antrum and mastoid cells are acutely attacked before the abscess can burrow through the drum, and

we then get an acute mastoid abscess, or even it may spread to the meninges, or lateral sinus with, naturally, very grave consequences.

It is therefore advisable in all these cases to make an early incision of the bulging drum and so establish drainage to prevent further extension of the disease as soon as we are certain there is fluid in the middle ear. The ear is practically identical with the appendix, a cul-de-sac, and we know that all appendicular abscesses are due to lack of drainage from blocking of its lumen, whether it be from a concretion or disease and swelling of the lining membrane.

Every case of acute middle ear inflammation should be put to bed and given a brisk purge of calomel. If there is any nose or throat trouble this should have appropriate attention, for the reason I have before mentioned—viz., to establish drainage through the Eustachian tube as soon as possible. Should the drum membrane be bulging the external auditory canal should be thoroughly disinfected by swabbing with 1 in 4,000 flavine or 1 in 20 carbolic, and the membrane freely incised under general anæsthesia; the incision being made in the posterior quadrant just behind the handle of the malleus and running crescentically down to below the tip. Gentle use of the Politzer bag is then made, which will open the Eustachian tube and force the fluid out of the middle ear. This fluid is then mopped out of the canal and a pledget of cotton wool soaked in flavine is placed close up to the drum, but must cause no pressure. This should be changed every few hours. One sometimes lightly plugs the canal with wool soaked in fifty per cent rectified spirit, which can be increased in strength if it causes no excoriation. Politzerization should be carried out at each dressing or the fluid extracted from the middle ear by gentle suction.

For the pain, which is sometimes very acute, glycerine of carbolic ten grains to one ounce is useful; a few drops warmed in a teaspoon and instilled into the ear, or a few drops of chloroform, will give relief; hot fomentation over the mastoid and auricle is always very soothing to the patient. Should the pain be very excessive and prevent the patient sleeping, ¼ grain morphia hypodermically may be given.

As there is always some post-nasal catarrh a warm inhalation of tinc. benz. co. every two hours will be of benefit, and will tend to relieve the congestion of the lining of the mouth of the Eustachian tube and help the necessary drainage.

Pain in the ear should never be passed over. It may only have its origin in a carious molar tooth or hard cerumen in the external auditory canal, but it is Nature's danger signal and should ever be regarded.

With regard to the chronic suppurative middle-ear cases, those who are, or should be, in Category C, I am of the opinion that a large number of these cases would be much better returned to civil life. They are always liable to acute exacerbation of the disease, with possible acute mastoiditis, with or without meningeal and lateral sinus implication. As far as my experience goes, a number of these men are permanently on the sick list, and go from one hospital to another, according to the locality to which their unit is sent. They are in this hospital a month or so, are then discharged, placed in Category C, and given some light duty for a week or so. Their unit is possibly transferred to another district. They there attend the hospital, become an in-patient once more for a month or so, and so the same procedure goes on *ad infinitum*.

Considering that such men, physically unfit as they are, are naturally more

exposed in the Army to the vagaries of the weather than in civil life, can we be surprised that they readily catch chills and are a prey to the various acute febrile diseases which are always, more or less, prevalent in camp and barrack life at certain periods of the year. For example, they take a chill, with subsequent nose and throat catarrh and implication of the Eustachian tube, swelling of the membrane of the middle ear, blocking of the aditus and antrum and prevention of outflow of discharge from the antrum, which is invariably diseased in all chronic suppurative ear cases, then acute mastoid abscess, etc.

This is exactly what is happening to-day in the Army much more than in civil life, and to the foregoing can be attributed the large number of cases of acute ear trouble one has to deal with in the winter months, and probably, from its geographical position, no place more so than wind-swept Salisbury Plain.

I am quite aware that a number of these suppurative middle-ear cases have been for months in the firing line, without any untoward symptoms, but these are cases in which there is a large perforation in the drum or possibly complete absence of the drum, there is no granulation tissue or polypi to act as a dam to the outlet of the discharge—in fact there is free drainage. On the other hand, where there are granulations or polypi and narrowing of the external auditory canal, osteitis is present. There is more or less a block to the discharge and the patient has periodic attacks of dizziness or headaches, etc., on exertion. Men in this latter category are certainly not fit subjects for the firing line, though the majority can do useful work at the base or on home service where work will not be so arduous, where they will not be so exposed to inclemency of weather, and at this same time can get treatment as out-patients and be saved from the possible more serious consequences to which I have before drawn your attention.

Nevertheless many of these are better out of the Army altogether for reasons before stated. At any rate, taken as a general rule, a man with a chronic ear discharge should not be in the firing line if it can possibly be helped, notwithstanding our knowledge that there are such men who have managed to carry on in spite of this disability.

The object of this paper is to draw attention to the large number of chronic suppurative ear cases which there are in the Army and in England generally to-day—also this number is growing greater from day to day—and for us to do everything in our power to lessen it.

After all, a man in Category C, taken as a rule, has only a twenty-five per cent value in the labour world. Therefore every case of suppurative otitis media which is allowed to become chronic is one more added to that already large army of physical inefficients.

This large army of chronic suppurative ear cases is daily being added to from a cause, new, and other than those I have already cited. There are a large and increasing number of cases now coming under my notice originating in rupture of the drum by high explosives and secondary infection of the middle ear, which for lack of continuous and expert treatment have become chronic. I am sure other Army otologists will bear me out in this statement, if they have kept careful statistics of every ear case coming to them during the last two years. These patients have their drum torn by the terrific concussions of high explosives, and though they may escape all other injury, are so dazed that they do not notice they

are deaf, and possibly have some slight bleeding from one or other ear. Probably not much notice is taken of it until, a day or so later, there is pain in the ear and a slight muco-purulent discharge. In other cases there is no pain, but only a slight discharge, and the man thinking it only trivial does not complain until it becomes profuse and is accompanied by marked deafness. They probably get treatment in the form of syringing, but the discharge and deafness still persist. I have had numbers of men give me a history of a ruptured drum and the above subsequent course.

It is up to the medical officer of a unit to instruct the men under his care at the Front that any slight discharge from the ear should have attention. They should be always on the look-out for such cases, knowing as they do of the possibility of their cause from high explosive.

KERNIG'S SIGN.

By Temporary Captain JOSEPH GEOGHEGAN.

Royal Army Medical Corps.

Late Government Medical Officer, Turks Island; District Commissioner and Government Medical Officer, Caicos Islands, etc.

Of the three methods of testing for Kernig's sign, the one most commonly adopted—departing, it is true, from that originally described—is to attempt passive extension of the leg, the thigh being flexed at right angles to the supine patient. The presence of increased tone in the hamstrings is the explanation usually accepted to account for a positive Kernig, i.e., the inability to completely extend the leg in these circumstances; and its main significance lies in its diagnostic value in cerebrospinal meningitis. It has also been noted in cerebellar hæmorrhage and some other basal conditions.

In the course of the recent outbreaks of influenza a number of cases of cerebrospinal meningitis appeared concurrently, and, a natural suspicion being aroused in all severe attacks of the former disease, it was found that in quite an obvious proportion of cases extension of the leg was more or less incomplete. Further it was noted that more than one definite case of cerebrospinal meningitis presented no greater degree of failure than many other patients beyond suspicion.

In these circumstances an attempt has been made to determine the normal range of variation. Men suffering from slight ailments and practically all up and about were examined on several separate occasions to the number of 212, the percentages being compared and found not dissimilar. None suffering from disabilities likely to interfere with or prejudice the test were included, and a special series of influenza cases war checked to ensure no possible source of fallacy in that direction.

The instrument employed, which takes but a few minutes to construct, consists of a hinged rod, one arm of which slides in a groove cut vertically in a base piece, forming a right angle with the given horizontal surface, e.g., the floor or a convenient table. To this same limb is fixed at the hinge an ordinary geometrical protractor, so that the angle made by the other arm is read off at once.

The patient being supine, with one leg held down straight, the other thigh is flexed to a right angle and, the instrument being adjusted, the angle of the line

great trochanter—external condyle of the femur with the line *head of the fibula—external malleolus* is readily seen. These points are sufficiently in a straight line in an ordinary subject in the anatomical position to form convenient and satisfactory landmarks.

The following statement embodies the results, grouped by tens for brevity. The angle noted indicates the angle of departure from the vertical after passive extension of the leg as far as possible.

1.	Angle of 0°	107	50·472 per cent
2.	,, from 1° to 10°	40	18·868 ,,
3.	,, from 11° to 20°	40	18·868 ,,
4.	,, from 21° to 30°	22	10·377 ,,
5.	,, over 30° *	3	1·415 ,,
		212	100 per cent

* 32°, 33° and 34° respectively.

The results obtained in this investigation are considered accurate enough to warrant the opinion that approximately fifty per cent of individuals will not comply strictly with Kernig's test; and that, to extend the inference further, the sign should not be regarded as positive unless an angle of 45° or thereby is plainly seen.

I desire to express my indebtedness to Colonel A. W. Browne, R.A.M.C., Officer Commanding this military hospital, for opportunity to make the above notes.

December, 1918.

Report.

STATISTICAL REPORT OF THE OPHTHALMIC WORK CARRIED OUT AT THE 2ND LONDON GENERAL HOSPITAL, ST. MARK'S COLLEGE, CHELSEA, S.W., FROM SEPTEMBER, 1914, TO THE END OF THE YEAR 1917.

By Major W. ORMOND.
Royal Army Medical Corps.

(*Concluded from p.* 242.)

Affections of the Conjunctiva.

Total number of cases		200
Conjunctivitis (simple)	78	
,, due to gas	46	
Trachoma	39	
Blepharitis	33	
Pterygium	4	
Simple conjunctivitis		78
Infective	49	
Traumatic	22	
Accidental	7	
Gas conjunctivitis		46
Without corneal complication	40	
With corneal complication	6	
Number of cases of conjunctivitis		124
(Including pterygium)		4
Number returned to duty	79	
,, sent to auxiliary hospitals	40	
,, discharged as permanently unfit	3	
,, of whose discharge there was no note	6	
Total number of cases of trachoma		39
Number returned to duty	20	
,, sent to auxiliary hospitals	5	
,, discharged as permanently unfit	13	
,, of whose discharge there was no note	1	
Total number of cases of blepharitis		33
Number returned to duty	24	
,, sent to auxiliary hospitals	5	
,, discharged as permanently unfit	3	
,, of whose discharge there was no note	1	

Blepharitis associated with errors of refraction or corneal opacities is responsible for a certain number of unfit men. Most of these were improved, but none permanently cured. The history was almost invariably a long one, and the condition was not obviously aggravated by military service. Probably the reverse was the case.

Conjunctivitis, etc.

The interest of this group lies in those cases of conjunctivitis due to gas. We received some very severe cases in which not only the eyes, but the skin of the abdomen, scrotum, penis and buttocks was also very severely burnt.

Two cases had such severe injuries of the cornea that complete opacity of each resulted and these two men were subsequently transferred to St. Dunstan's.

One instance of keratitis—the result of gas—was slight, and six of conjunctivitis, in which the cornea was also involved, were severe.

Where destruction of the cornea resulted the cause was probably that the actual liquid had reached the corneal membrane, as these cases were the result of gas shells bursting close to the face.

In the early stages soothing treatment was employed such as hot fomentations, irrigations with normal saline and carbonate of soda lotions, boracic ointment, liquid paraffin, etc. After about a fortnight however more astringent treatment by sulphate of zinc, protargol, exposure to fresh air and light were insisted on, and any case that remained in hospital more than a month was specially considered and reported on.

No cases were readmitted during this period, and special efforts were made to prevent these lapsing into cases of chronic photophobia with functional blindness, although we received two or three cases sent to us under the impression that they were cases fit to be transferred to St. Dunstan's.

Injuries to the Globe the Result of Contusion and Concussion.

Total number of cases		266
Wounds the result of contusion	110	
,, ,, of concussion	117	
Concussion blindness	39	
Contusion wounds		110
Number returned to duty	52	
,, sent to auxiliary hospitals	22	
,, discharged as permanently unfit	3	
,, of whose discharge there was no note	32	
,, died	1	
Concussion wounds		117
Number returned to duty	73	
,, sent to auxiliary hospitals	30	
,, discharged as permanently unfit	7	
,, of whose discharge there was no note	7	
Concussion blindness		39
Number returned to duty	18	
,, sent to auxiliary hospitals	9	
,, discharged as permanently unfit	4	
,, of whose discharge there was no note	8	

Contusion Injuries.

The differentiation between wounds due to contusion and those due to concussion is difficult to maintain and probably many cases ought to be transferred from one category to another. By concussion is implied a "shaking" and by contusion a "bruising," but obviously a bruising is capable of starting

vibrations in the deep part of the globe and so becoming capable of producing a concussion injury. Contusion, however, implies direct contact, whereas concussion injuries may be due to vibrations conveyed from a distance.

CONCUSSION INJURIES.

Under this heading are grouped injuries done to the globe by indirect violence causing rupture of the choroid, retina, iris and lens capsule, and resulting in intraocular hæmorrhage, iridodialysis, irregular pupil and cataracts. Intraocular hæmorrhage in some instances where it was slight failed to obscure the view of the fundus and disappeared rapidly by absorption. In others it appeared, on the contrary, to increase so that details of the fundus, which had been seen and recorded, became after a time entirely obliterated and the red reflex lost. This may be due to one of two conditions:—

(1) Either fresh hæmorrhage occurs some days or weeks after the injury, even when the patient has been kept in bed and at rest, or:—

(2) A mass of hæmorrhage encapsuled and confined as it were to one part of the vitreous chamber, subsequently, owing possibly to a rupture of the membrane confining it, and a liquefying of the vitreous, becomes dispersed over the whole posterior chamber, thus obliterating the red reflex entirely. In some cases it was absorbed later on and in others, owing to its size and density, became discoloured, organized and changed into soft snow-white masses, which later again shrank and drew away the retina, subsequently leading to detachment and a shrunken soft eye.

The most satisfactory way of dealing with these masses of blood has proved to be by mechanical means, i.e., massage, and the time taken for the absorption of the blood varied from one to two months.

Another point of interest is the time which elapses after the injury, before the lens turns opaque. It may be only a few days, but I have had some cases in which the lens has remained clear for six months and then became opaque.

Ruptures confined to the retina and appearing ophthalmoscopically as "holes" at the macula are of course rare compared with the far commoner cases of rupture of the choroid, involving the retina as well, but commoner still are the ruptures of the choroid in which the retinal vessels can be seen to pass over the rupture undisturbed.

CONCUSSION BLINDNESS.

One of the principal ocular features of the War has been the number of cases of functional blindness due to the violent explosions caused by high explosive shells, bombs, hand grenades, etc. These cases may or may not have sustained definite organic injuries, but the clinical symptoms characterizing their functional nature are very clearly marked.

Usually the patient has been rendered unconscious by an explosion in his close vicinity, and on regaining consciousness he finds that he is unable to see. When examined he presents the following symptoms: The eyes are kept closed, the lids may be frequently "fluttered," or as one man stated, "he could not keep his eyes from twinkling." On attempting to open the lids the patient resists forcibly by means of his orbicularis; when this is overcome to a sufficient extent to see the globes, they are found to be rolled forcibly upwards, and the pupils are always kept covered by the lids; he has great difficulty in looking

downwards, and complains of pain and photophobia, and shows marked fatigue as a result of the examination. In some cases I have noticed an acceleration of the pulse-rate and also perspiration. The photophobia is not, however, really influenced by light, as the condition does not diminish in very subdued illumination; these patients never move about as blind men would, they invariably avoid hurting themselves; but all the same they never relax, even if watched for weeks at a time, the groping action of people with extremely defective sight, and judged by every test they maintain this condition indefinitely, and are undoubtedly psychically blind; the pupils react normally, and the fundus shows no definite change. There is no difficulty in differentiating them from malingerers, as they pass through long periods of real mental distress and serious discomfort. These cases vary enormously in severity; some recover rapidly, others seem to go on indefinitely if not treated, or if treated unsuccessfully. Any lack of recognition of the condition in the early stages enormously prejudices the prognosis.

Affections due to Direct Injury.

Total number of cases..		163
Foreign body in eye and orbit	116	
Perforating wound of eye ..	31	
Injury to orbit involving accessory sinuses ..	16	
Number of cases of foreign body		116
Number returned to duty ..	84	
,, sent to auxiliary hospitals ..	25	
,, discharged as permanently unfit	1	
,, of whose discharge there was no note	6	
Number of cases of perforating wound of the eye		31
Number returned to duty ..	22	
,, sent to auxiliary hospitals..	7	
,, discharged as permanently unfit	1	
,, of whose discharge there was no note	1	
Number of cases of injury to orbit		16
Number returned to duty ..	7	
,, sent to auxiliary hospitals..	6	
,, of whose discharge there was no note	3	

Foreign Body in Eye and Orbit.

In this group of cases are instances where various foreign bodies, mainly of metallic origin, struck the globe and inflicted damage. The nature of the missile varied—splints of shrapnel, lead, brass, iron (magnetic and non-magnetic), stones from the road, sand, wood and bone.

Generally speaking the small fragments which were stopped by the resistance of the cornea or sclera resulted in comparatively small permanent damage to vision, and most of the cases regained good vision ($\frac{6}{12}$ and $\frac{6}{6}$) after a long period of acute conjunctivitis and keratitis with photophobia.

Where fragments were brought to rest in the anterior part of the eye, in the anterior chamber or iris, good results were obtained; the vision ultimately averaging $\frac{6}{36}$ and $\frac{6}{18}$. Those, however, in which particles of metal of even small size penetrated deeply into the vitreous, retina and choroid were usually responsible for severe damage, poor vision and often loss of the eye entirely.

Metallic fragments damaging the eye by striking the globe without actually penetrating the tunic and coming to rest in the orbital tissue gave varying results, according to the size of the fragments and the tissues involved.

Where the optic nerve was actually torn across, complete blindness resulted, but often severe intraocular hæmorrhage, with solid detachment of the retina or traumatic cataract, would result from these non-perforating wounds.

Some pieces of metal undoubtedly traversed the globe, entering on one side and passing out again, and in these cases also severe damage to vision resulted.

A large number of eyes which were found to be tolerant of the presence of metallic or other foreign bodies were left alone: if the extraction of the particles by the magnet was found to be impracticable (the fragment not reacting to magnetic force), or if the fragment was in such a position and of such a size that the removal would probably result in a loss of vision, which would render the eye useless.

The results of the extraction of foreign bodies by the electro magnet when they have penetrated deeply into the globe are disappointing, but we must remember always that the mere passage of the metal, the violence of the impact, the resultant hæmorrhage preclude the possibility of a good result apart from the necessary damage resulting from the extraction, however skilfully done. Also it must be remembered that the cases sent to us from France would only be, in all probability, those that had received severe damage; the slighter cases being treated in the Base Hospitals at Boulogne, Rouen, etc.

Perforating Wounds of the Eye.

Included under this heading are thirty-one cases, one eye only being involved; the majority had prolapse of the iris and after iridectomy seventeen obtained vision of $\frac{6}{24}$ or more, while more than half had vision equal to or better than $\frac{6}{60}$; the greater number were due to pieces of metal striking the eye with considerable violence.

These cases do not include those which had traumatic cataract. From the point of view of surgical interference they form a satisfactory group—as none of them was lost by septic inflammation and the majority retained useful vision, in spite of the severity of the original injury.

Injury to the Orbit involving the Accessory Sinuses.

This group is really a large one, but most of the cases are grouped in the blind category, as the "Through and Through" wounds perforating the orbits and nasal or other accessory sinuses often caused so much damage that the patient was rendered quite blind. These sixteen cases, however, received damage mainly to one side. The symptoms of involvement of the accessory sinuses are—bleeding from the nose, discharge of pus or muco-pus from anterior nares or into the throat, anosmia, acute sinusitis with abscess formation and later persistent sinus formation, blocking of the nasal airways, supraorbital pain, and pain about the orbits generally, with œdema of the lids. It is however remarkable what extreme mischief can be done to the bones of the face and the sinuses, and the patient make no complaint at all: most of the symptoms develop late and the involvement of the ethmoidal and maxillary sinuses often produce symptoms months after the occurrence of the wound.

AFFECTIONS OF THE UVEA.

Total number of cases		177
Iritis	96	
Choroiditis	47	
Cyclitis	34	
Number of cases of iritis		96
Number returned to duty	51	
,, sent to auxiliary hospitals	28	
,, discharged as permanently unfit	6	
,, of whose discharge there was no note	11	
Number of cases of choroiditis		47
Number returned to duty	16	
,, sent to auxiliary hospitals	5	
,, discharged as permanently unfit	21	
,, of whose discharge there was no note	5	
Number of cases of cyclitis		34
Number returned to duty	21	
,, sent to auxiliary hospitals	9	
,, of whose discharge there was no note	4	

IRITIS.

As causes of iritis these cases represent: Syphilis, acquired and congenital, gonorrhœa, sepsis, mainly from the condition of the teeth and mouth generally, traumatism, the result of small, often minute septic particles of dust, stone or metal being driven into the cornea and in some cases into the anterior chamber; and malaria in which blood was at the time of examination teeming with the benign quartan parasites, and the Wassermann reaction was negative.

There is no doubt that cold and damp precipitate an attack of inflammation in those who have some latent septic focus present about them, and that an uncured prostatitis or urethritis is often the primary cause of recurrent attacks, which are claimed as being due to the cold and damp of the trenches. This was more specially remarked in the winter of 1915-16, and amongst the junior subalterns.

As is so often found, a certain number of these cases seemed to occur spontaneously and no septic or infected association could be found to couple with the inflammation of the iris.

Of these cases 12 were due to acquired syphilis; 8 were due to inherited syphilis; 13 were due to gonorrhœa; 12 were due to traumatism; 40 were unexplained; 9 were due to septic teeth; 1 was due to malaria; 1 was due to tubercle.

CHOROIDITIS.

Twenty of these cases are due to acquired or inherited syphilis. Others are associated with myopia of a high degree, traumatism or oral sepsis, and in others no certain etiological factor could be ascertained.

CYCLITIS.

The causes in this group are mainly three: Traumatic, septic from teeth, syphilitic. The same three causes were responsible for most of the cases of iritis.

A few, however, had more unusual etiological factors such as malaria, dysentery and trench fever. It would be expected that metastatic cyclitis and iritis would occur in connexion with extensive wounds with suppuration, but this has only occurred in a very few cases, and those few are not of absolute certainty.

Affections of the Optic Nerve and Retina.

Total number of cases		62
Optic nerve; atrophy and neuritis	47	
Detachment of retina	15	
Number of cases of optic nerve, &c.		47
Number returned to duty	17	
,, sent to auxiliary hospitals	4	
,, discharged as permanently unfit	12	
,, of whose discharge there was no note	14	
Number of cases of detachment of retina		15
Number returned to duty	11	
,, sent to auxiliary hospitals	3	
,, of whose discharge there was no note	1	

Optic Atrophy.

Optic atrophy forms a large and varied class, and the cases found in our records illustrate very well the many different etiological factors that produce this condition.

It should be pointed out that the cases of optic atrophy due to *direct injury* are not included in this list, only those traumatic cases the result of *indirect damage* from blows on the nose, orbital margins, and bones of the face, where the nerve condition was the most marked result of the blow. Also as optic atrophy generally involves both eyes many cases of atrophy will be found among the blind men sent to St. Dunstan's, and are entered under that heading.

Syphilis, both inherited and acquired, claims over a third of the total number.

Of the cases of atrophy, the result of severe hæmorrhage, I have seen one case and that was not very convincing. This fact supports the contention that where optic atrophy has resulted from severe loss of blood the patient has some general constitutional factor which has caused a general debility and that severe hæmorrhage the result of warfare, in perfectly healthy men, does not seem to produce optic atrophy.

Malaria and quinine both figure as causes of optic atrophy, and the usual attenuation of the central retinal vessels was seen in most cases due to quinine.

The familiar type of atrophy occurring in young men and characterized by a central scotoma, often designated Leber's type, gave four instances, and lastly, there are also included cases similar to those with which we were familiar before the War in our civilian out-patient work of optic atropy associated with no other symptoms discoverable at the time of examination. However, one patient of this class died eighteen months later of G.P.I.

Detachment of the Retina.

These were either fluid, due to the presence of subretinal exudation, or solid, due to blood which in many cases had organized. Trauma was not infrequent in the history, and myopia was the cause of two.

MYOPIA, ETC.

Total number of cases		59
Myopia	54	
High degree of astigmatism	5	
Number of cases of myopia		54
Number returned to duty	37	
,, sent to auxiliary hospitals	2	
,, discharged as permanently unfit	12	
,, of whose discharge there was no note	3	
Number of cases of high degree of astigmatism		5
Number returned to duty	3	
,, sent to auxiliary hospitals	2	

High myopes and men with high degree of ametropia associated with defective visual acuity are included in this group.

The myopes frequently had patches of choroidal atrophy and a large proportion were either discharged the Service or put into very low categories. These men were all received into the wards of the hospital, and are not included in those attending the Out-patient department: they were found to be unable to carry on their duties in France and elsewhere, and were returned for re-categorization or permanent discharge.

INTRAOCULAR HÆMORRHAGE, VITREOUS OPACITIES.

Total number of cases		109
Number returned to duty	66	
,, sent to auxiliary hospitals	36	
,, discharged as permanently unfit	1	
,, of whose discharge there was no note	6	

Of these 109 cases: Eighty-one were due to injury from explosion, shrapnel fragments being violently driven against the eye, in some cases penetrating it; seventeen were due to bullets passing close to the globe and rupturing the membrane by concussion vibrations; four were spontaneous, no cause being ascertained; four were due to accidents (barbed wire, wood, etc.); three were not recorded in sufficient detail to say if shell splinter or bullet was the cause; twenty-six had vision equal to or better than 6/60; nineteen had a foreign body in the eye, or had had one removed.

This category comprises those patients in whom hæmorrhage within the eye was the main clinical feature when the case arrived in hospital. The time taken for the blood to absorb varied from one to six months according to the amount present and the degree of damage done to the tissues. The result in most cases was that after the vitreous cleared ruptures of the choroid and retina were found. Some of the blood became organized and formed masses of snow-white tissue, often with bands stretching across the fundus in various directions and sometimes resulting in detachment of the retina owing to shrinkage.

NYSTAGMUS.

Total number of cases		15
Number returned to duty	7	
,, sent to auxiliary hospitals	1	
,, discharged as permanently unfit	6	
,, of whose discharge there was no note	1	

Of nystagmus there were fifteen cases, all either congenital or due to defects of vision acquired during early infancy; these men had all been employed in France but failed to be able to continue to fulfil their military duties; they were either discharged the Service as permanently unfit or kept for home service, and many could claim an aggravation of their symptoms owing to military service.

A large number of men—similar in condition—were seen as out-patients and were dealt with previous to being sent abroad.

It is doubtful if men with nystagmus (if well marked and associated with considerable ametropia and defect of visual acuity) ought to be employed at all for active military service.

Lachrymal Obstruction.

Total number of cases		14
Number returned to duty	8	
„ sent to auxiliary hospitals	5	
„ of whose discharge there was no note	1	

A large number of cases in which the lachrymal canaliculi and ducts were damaged are to be found in other categories, for instance among "Men blinded in the War," and "Injury to the Orbit involving the Accessory Sinuses," but a certain number were isolated cases and these were usually treated by antiseptic drops, etc., for a time and then if the condition still remained unsatisfactory the sacs were excised.

Strabismus.

Total number of cases		13
Number returned to duty	12	
„ of whose discharge there was no note	1	

All these cases except two were convergent concomitant squint. Two only were divergent. They were associated with astigmatism or amblyopia in one eye, and were usually sent by the Military authorities for treatment.

Nerve Injuries.

Total number of cases		9
Number returned to duty	4	
„ sent to auxiliary hospitals	4	
„ of whose discharge there was no note	1	

The number of cases is large in which the muscles or nerves supplying the muscles are damaged; all the cranial nerves from the first to the eighth inclusive have been involved in patients who have been included in various categories. A few cases however have occurred in which the most marked result has been due to the damage done to the nerves and the diplopia consequent on this main symptom troubling the patient.

Three cases of congenital ptosis were operated on, one associated with jaw movements.

GLAUCOMA, EPISCLERITIS, NEURASTHENIA, AFFECTIONS DUE TO VARIOUS CAUSES.

Total number of cases		29
Number returned to duty	14	
,, sent to auxiliary hospitals	4	
,, discharged as permanently unfit	5	
,, of whose discharge there was no note	6	

Total number of cases		29
Glaucoma	4	
Episcleritis	5	
Periostitis around orbit	3	
Syphilis	2	
Congenital dislocation of lens	1	
Exophthalmic goitre	1	
Neurasthenia	9	
Burns	1	
Injury to occipital lobe	2	
Hemiplegia	1	

PLASTIC OPERATION.

Total number of cases		64
Number returned to duty	37	
,, sent to auxiliary hospitals	21	
,, discharged as permanently unfit	2	
,, of whose discharge there was no note	4	

A large number of cases of deformities in which plastic operations were performed are included in other categories, for instance, St. Dunstan's men, etc.

These cases placed together here have not been included elsewhere and were admitted for the purpose of having scars removed or deformities remedied by plastic surgery. They are, for the most part, intermediate in point of time, and by that I mean they were operated on, or were sent for operation when the wounds had only just healed, and were thus intermediate between the cases operated on within the first week and the late cases, which are dealt with twelve or eighteen months after being wounded.

It is impossible to deal with them individually in a mere statistical report such as this, but it may be said that most were improved by means of flaps with pedicles attached, and no great number were dealt with by grafts removed from distant parts of the body.

In most cases suppuration had taken place in the area operated on and the early disturbance of healed tissues necessitated by the operation resulted in most of the cases healing by marginal granulations, with some septic discharge.

The number of failures were few; the pedicules being sufficient to sustain the vitality of the graft, and the high degree of health and fitness of the patients ensured a good blood supply and a vigorous reaction and resistance to the invading organism. In fact a justifiable criticism might be passed on the earlier efforts, viz., that the grafts were too small, and not enough boldness was displayed in removing large enough pieces of tissue for transference, with the result that months later the shrinking which took place caused some disappointment, as in the case of contracted sockets.

Sometimes a second operation was necessary owing to the contraction being

so great that a glass eye too small for cosmetic reasons was all the space would allow.

Ectropion, contracted sockets, torn lids, destroyed lids, bridge to nose, the removal of adherent scars and the closing over of the holes leading into the nasal cavities, and sinus (the result of bullet wounds), were among the commoner cases sent for operative interference.

Accidents.

In going through the medical case sheets of these 2,774 men the number of injuries due to accidents other than those directly attributable to enemy action seemed to be large, and it was thought to be of interest to tabulate these cases and record them.

The number of preventable accidents then numbered 160.

The premature bursting of bombs, cartridges, etc., thrown into the fire, accidents from "horseplay," wood-chopping, generally by incorrect tools (such as chopping wood with a pick axe), kicks from a horse, the inspection and manipulation of metallic objects picked up casually on the battlefield, etc., cause the majority of these.

One of the most tragic and at the same time most stupid accidents was the result of lighting a fire on the top of a box filled with unused hand grenades.

Many of these accidents happened at home in the bombing schools and schools of instruction, but more were received from abroad; the percentage is higher than one would have expected.

In summarizing this statistical report it must be pointed out that no mention has been made of a very important fact regarding the work of the department, viz., that cases having very slight ophthalmic interest but very serious general surgical wounds were habitually treated and nursed by the staff, owing to the Army regulations that all ophthalmic cases were to be drafted to the ophthalmic wards; it therefore sometimes happened that, for instance, a man who had had an eye removed in France was placed in the ophthalmic wards even though he had a bad compound fracture of the thigh or arm, wounds of the chest or shoulder, and had this not been so the average time spent by each patient in the wards would undoubtedly have been considerably lower.

It cannot be maintained that the record is entirely complete as no arrangements were made to facilitate the recording and categorizing the medical records from an ophthalmic point of view; and also many cases were transferred to the Colonial authorities together with their medical case sheets before copies had been secured, although this only occurred, as a rule, when the rush of work was considerable; such cases as may have been missed however would not be of sufficient number to materially alter the record as typical of the material passing through a large Military Ophthalmic Department.

Reviews.

LOCALIZATION AND EXTRACTION OF PROJECTILES. By Ombrédanne and Ledoux-Lebard. Edited by Lieutenant-Colonel A. O. Reid, C.M.G. London: University of London Press, Ltd. 1918. Pp. xxv + 386. Price 10s. 6d. net.

The main object of the work, as indicated by the title, is to describe methods for localization and extraction of projectiles: a subject brought into great prominence during wartime.

The first part of the work is devoted to a discussion on the production and properties of X-rays, and on the technique of their employment as an aid to surgery.

The importance in all radiography of proper centring of the X-ray tube is wisely emphasized and the principles of interpretation of X-ray appearances are discussed in a most interesting fashion.

The authors here recommend as a standard practice that all plates should be examined with the glass side turned towards the observer so that the image seen will correspond in orientation to that seen on a fluorescent screen and on a print made from the plate. This procedure is contrary to that usually followed in this country, and may not recommend itself to other workers, but the reasons for its adoption and its advantages are clearly and interestingly stated.

In this section, as elsewhere in the book, a method of reproducing X-ray appearances in woodcut is freely used, and the result is highly successful in making the numerous diagrams most lucid and instructive.

Several plates are also inserted which reproduce actual radiograms showing foreign bodies in various situations. These plates are excellent examples of the art of reproduction, and their instructive value is correspondingly great. The section on apparatus is especially interesting to British workers as giving some idea of French practice, the Dessane fluoroscope being a special instance, but it is when we come to the later and larger part of the work dealing with "Foreign Bodies" that the real interest and value of the work appears.

We are aware of no other work which deals so exhaustively with the subject of localization, and our French colleagues, the authors, are to be sincerely congratulated on their industry in collecting such a number of different methods, and on the clearness of their exposition of the principles of those methods. The editor of this English edition has carried out his duties in a manner that accentuates this clearness of exposition, a result not easily achieved in a translation.

If one criticism may be offered, it is that little or no guidance is given as to the relative merit to be ascribed to the various methods as tested under practical conditions. This may be asking rather much of the authors, but many of the methods are entirely new to British workers, and from the necessarily brief résumé of each it is difficult to assess their value. The space devoted to any method depends rather upon its complexity than its value, and several of the compass methods described at considerable length seem to be ruled out from practical consideration on account of the complicated apparatus involved. On the other hand, the simpler Roussell and Strohl processes receive relatively brief notice, and yet on the principle of these are based the closely similar methods on which both American and British workers had come to rely mainly in their later work in casualty clearing stations and base hospitals.

This detracts very little, however, from the value of the work under review, and as a historical survey of, and practical guide to, methods of localization it stands unrivalled.

A chapter on anatomical localization is very practical and valuable, as also is a later chapter on special peculiarities of certain regions.

Processes of Extraction in Chapter XIII are divided into chance processes, precision processes, and processes of certainty.

The latter are based on the principle of the operator *seeing* what he is doing or what he should do, and amongst those processes preference is given to the process of "extraction with the aid of intermittent control." In this latter, the radiologist is in close and continued co-operation with the surgeon during the operation of extraction, and by means of a "bonnet de Dessane," consisting of an eclipse fluoroscope fastened on his head, he guides the latter by indicating at the commencement, and as required during the operation, the exact point of exit of the normal ray passing vertically through the foreign body. All the surgeon requires to do, under such guidance, is to cut down vertically till he reaches the foreign body.

As stated by the editor in his preface "the description makes the process appear fascinatingly simple, so much so that there is a risk that non-experts might be tempted after reading it to undertake extractions which would be unjustifiable or at least better left alone."

The danger of X-ray exposure will suggest itself at once to every experienced worker, and partly on that account the method has not found favour in this country. Nor does the procedure find much favour with our surgeons, but every radiologist should be familiar with the method, and every surgeon should be aware of its possibilities. On that account, as well as for its many other merits, the work under review should prove of great interest and value to both classes of practitioners.

Military Medical Manuals: Electro-Diagnosis in War. Zimmern and Perol. Edited by E. P. Cumberbatch. London: 1918. Pp. xxiv + 212. Price 7s. 6d.

As stated in the Preface, the subject of this volume is the use of electrical methods in the diagnosis and prognosis of the injuries and diseases of the nervous system which are encountered in war. This subject really includes all purposes of electro-diagnosis, and those are described and explained in a thorough and interesting manner, making the volume a most valuable one to all medical workers in peace time as well as in war.

Chapter I deals with technique, and includes a clear and complete description of normal reactions as the essential basis of all attempts to define, or to make deductions from, the abnormal.

In this connexion the authors plead strongly and consistently for the use of standard tests with standardized apparatus, so that the results obtained by different workers may be readily comparable; and throughout the work useful suggestions are made, and directions laid down, for that purpose.

The diagrams and illustrations throughout the work are excellently reproduced, and are most instructive in character. The various motor points are clearly indicated and discussed, and this section is made especially interesting and instructive by the printing of parallel diagrams showing the anatomical relations of the motor points indicated on the surface of each part.

The significance of the "reaction of degeneration" is fully discussed in Chapter II, and the conditions of its reliability as a guide in prognosis are clearly indicated, the authors insisting that this or any other reaction should not be relied upon alone.

The necessity for controlling the conditions of testing—such as temperature of the limb examined, etc.—is clearly pointed out; this detail is typical of the thorough and excellent manner in which the work deals with the whole subject.

Motor paralyses are completely discussed in Chapter III, and at the present time the detailed information contained and discussed in this chapter is of great interest; whilst the section in Chapter VI, dealing with reports for medical boards, places this question upon a logical basis that should prove of especial value to those concerned with such matters.

Disorders of sensation, including the galvano-psychical reflex, are discussed in Chapter IV, whilst Chapter V deals with the interesting and little understood phenomena elicited by passage of electric currents through the head.

The subject here dealt with is usually confined to a single chapter of a book dealing with other electro-medical subjects as well, but the present work thoroughly justifies the innovation of devoting to electro-diagnosis a separate volume, the result being a most convenient and valuable manual, upon the production of which authors and editor are worthy of congratulation.

To students of electro-medical diagnosis, the book should prove most useful, whilst to electro-medical experts and neurologists the book is full of helpful suggestions for individual and co-ordinated work.

Studies in Electro-Pathology. By A. White Robertson. London: Routledge. 1918. Pp. viii + 304. Price 12s. 6d. net.

This is undoubtedly a most interesting, even a stimulating book, but it is unorthodox in structure, nomenclature and matter. The assumptions made are many and varied, and, although it cannot be said that they are always well founded, the original views of the author are refreshing. He has the courage of his convictions. The literature he has consulted is in the reviewer's opinion not all sound. Critical as is the author's mind he seems at times to be too ready to accept the written word, and yet, on the other hand, there is direct evidence that he has thought deeply over his selected subject. Withal it is an annoying book; an attempt has been made to get too much into one volume. It could easily have furnished two interesting general essays, a short monograph and an introductory clinical manual on treatment.

Major White Robertson's views on the treatment of wounds by means of liquid paraffin either simple or combined with other materials are too well known to require discussion here. This book is his vindication of the rationale of his method. He wanders over a wide field and it must be admitted he correlates facts and observations in a most striking fashion. The weakest section, in the present reviewer's opinion, is that devoted to the consideration of food. In spite of the acknowledged deficiencies of the present methods of assessing food values, it is felt that they will not be supplanted by the ideas put forward in this volume.

This book certainly offers, as it claims, a fresh view of the nature and functions of the body lipoids, but it cannot be said the author has proved his contention that the body is primarily an electrical machine.

Reference must be made to the two really beautiful and instructive coloured plates which serve as a frontispiece.

Malaria and its Treatment in the Line and at the Base. By Captain A. Cecil Alport, R.A.M.C.(T.), M.B., Ch.B.Edin., late Acting Major, Officer in Charge of Medical Division of the 28th General Hospital, and of the 41st General Hospital, Salonika. London: J. Bale, Sons and Danielsson, Ltd. 1919. Pp. xii + 279. Price 21s. net.

The author of this work is to be congratulated on the evidence of energy displayed in getting the material together under adverse conditions partly at the Base and partly at the Front, and in finding publishers to put it before a malaria-alert world.

In the preface he says: "I have had little or no access to the literature on

the subject, and have had to rely on my own observations, experiences, and knowledge."

The title of the work is: "Malaria and its Treatment in the Line and at the Base." Out of some 260 odd pages, twenty-five are concerned with the entomology and parasitology of malaria; the rest deal with the clinical features and treatment of malaria, its sequelæ and complications.

The consideration of treatment is mainly a story of the author's struggles to enforce on none too willing colleagues his belief in what he describes as "the large dose intravenous and intramuscular quinine method of treating cerebral and other severe pernicious types of malaria."

On page 17 the author says: "It is a *sine qua non* that experience, and experience only, justifies a man in venturing opinions on any given subject."

As the work teems with opinions (statements) on entomology, parasitology, parthenogenesis, blackwater fever, prophylaxis, symptomatology and treatment, of a finality that is surprising from one who has had "little or no access to the literature on the subject," any "busy general practitioner" or "average layman" seeking the "opinions" of "experience" of malaria at the Base and at the Front in Salonika, will have much to divert him and to marvel at for the price of 21s. net.

A reviewer is handicapped in face of the confession by the author of inacquaintance with the literature of a subject on which he proceeds to dogmatize. The stamp of that inacquaintance is marked in almost every paragraph not concerned with the author's experience. Where that experience of treatment by the "large dose intravenous and intramuscular quinine method" is a personal record, the author deserves credit for having insisted strenuously, and in face of the opposition of contrary dogma, on a recognized method of treatment generally resorted to in valid cases by practitioners of experience in malaria. The figures indicate that good results were obtained by this method of treatment.

There are some interesting pictures in the book, of patients being brought to hospital, of smiling men brought back to life after severe malaria, of malaria parasites, and of mosquitoes. Some of those of parasites and of mosquitoes either have been depicted from abnormal specimens or owe their characterization to the creative zeal of the artist.

ANGUS MACDONALD.

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THE SANITATION OF A FIELD ARMY.

By LIEUTENANT-COLONEL HANS ZINSSER, M.C.
Sanitary Inspector, 2nd Army, A.E.F.

A BODY of troops is a community in which, in addition to organization for combat, provision must be made for all the needs of a civilian community, for supply of food and water, for shelter and warmth, for refuse disposal, for personal cleanliness and laundry, for care of the sick, and for all the other innumerable details that arise where human beings live in crowded places. The military sanitarian has some advantages over his civilian colleague. He has his community under more rigid control than the latter and the individuals comprising it are young and hardy. These, however, are his only advantages. To offset this, he is confronted with the difficulties that arise from the housing of many men in barracks, from the exposure and hard work that form the daily routine of their lives and, most important of all, from the fact that all his arrangements must be made with the clear recognition that there will be times when all considerations of health must become subordinate to the purposes for which his community has been formed, namely, the training for combat and battle.

In training areas and base sections, the problems of military sanitation are very similar to those of civilian work. In the case of an army occupying a front line sector, the conditions are modified by the many factors which active warfare involves. It is these latter problems that we wish to consider more particularly.

The organization of divisions is based upon the necessity for mobility. A division is a spear which must be thrust and withdrawn as military needs indicate. It must be complete in itself and carry within its organization the elements of all the parts necessary for independent functioning. Often

a gain in mobility involves an inevitable loss of efficiency, and the sanitary organization of divisions therefore must necessarily do without many of the arrangements that are possible only in a permanently organized territory with extensive laboratory facilities, bathing and disinfection apparatus and all the other devices which are perfectly arranged only when more or less permanent occupation of an area is possible.

Divisions are gathered in corps, and the corps occupies an area. But as warfare was developing just before the armistice was signed, the corps was a tactical unit and its headquarters were changing almost as frequently as divisional stations. Consequently corps areas were shifting to meet the rapidly changing necessities of strategy.

It is in the Field Army only in which we can, for the present, count upon the occupation of an area for a reasonably definite period; long enough, at least, to justify the undertaking of extensive organization and construction, with relation to territory occupied; and it is only in the army organization, in which we can formulate a system of sanitation based on area, which can so reinforce the divisional organizations as to fill in the defects existing in the latter by reason of their greater mobility.

An army sanitary organization, under conditions of warfare such as those which, until recently, prevailed in France, should be so constructed that it combines careful sanitary scrutiny and control, with sufficient mobility to adapt itself to advances, to the shifting of flanks, contractions and expansions of the occupied territory.

When the British armies first entered the battlefields of Flanders, they had sanitary squads or detachments attached to divisions just as we had them in the old tables of organization. It soon developed that an army area is a section throughout which a continuous shifting and re-arrangement of the composing element must take place. Divisions move forward into the line, remain in position for varying periods and are withdrawn for replacements and rest. Other divisions move forward from reserve positions to take their places. Artillery changes its emplacements. Supply and ammunition trains, engineering detachments and labour troops move about whenever needed.

Within the more or less constant limits of the army area a continuous circulation of units takes place, a shifting of troops to and fro, an active wandering about like that of ants in a hill. It is apparent that there is much wasted energy and loss of efficiency if every division is required to organize its sanitary arrangements *de novo* whenever it is moved. The knowledge gained and the work done by one division is lost to the one that moves into its place, and a new investigation of water sources, billets, dumps, latrines, baths and everything bearing upon the control of disease becomes necessary whenever divisions change locations. It has been found, in consequence, that some form of constant central supervision by the Army itself will remove these obvious defects. This is the principle which underlies the British army sanitary organization, and it is this

system, in its essentials, that we have found worthy of emulation. We have borrowed from the British system certain essential elements but have attempted to adapt these to the more mobile conditions which prevailed on all parts of the front during the latter months of the war. The following outline describes briefly the plan instituted in the 2nd Field Army, A.E.F., with the official approval of the commanding General. The plan is similar in most of its details to that conceived and carried out for the supervision of the advance section, A.E.F., by the chief surgeon of that section, but differs from this in the attempts made to remain prepared for sudden extension forward of the army area, and the rapid organization of conquered territory.

Outline of Plan for Area Sanitation, 2nd Army.

The army area is divided into administrative sub-divisions to be known as *sanitary sections.* The area as at present constituted will be divided into three such sanitary sections, and in the future expansion or change in the territory occupied by the 2nd Army can be easily adapted to corresponding changes in the sub-divisions. In a central point in each sanitary section there will be stationed one commissioned officer, lieutenant or captain, Medical or Sanitary Corps, chosen for his training in practical sanitary methods. Each sanitary section will be again sub-divided into eight to twelve *sub-areas.* These will be so outlined as to be small enough to be patrolled on foot, thus obviating the necessity for additional transportation. Into each sub-area will be placed two or three enlisted men and non-commissioned officers chosen for their general intelligence and training in sanitary inspection. Further training will be given these men by the commissioned officer commanding the squad in each sanitary section. It seems likely that a number of sanitary squads so selected can at the present time be obtained from personnel or divisional sanitary squads now assigned to the S.O.S.

Duties.

I.—Duties of the commissioned officer in charge of squad. The commissioned officer assigned to each area will :—

(1) Maintain in the town of his station a sanitary school for the instruction of non-commissioned officers and enlisted men of sanitary squads, and a shop for the construction of sanitary appliances, such as latrine seats, etc.

(2) He will select and distribute men of his squad to the eight to twelve sub-areas in the section. He will direct and advise the work of the men in the sub-areas by receiving reports and keeping in constant touch with them, by circulating in his area.

(3) He will keep in touch with all matters of sanitary importance in his section and furnish all such information to zone majors, medical officers and commanding officers of all units that enter the area.

(4) He will keep in constant touch with corps and division surgeons in his area, furnishing them all information at his disposal.

(5) He will be directly responsible to the chief surgeon of the 2nd Army through his sanitary inspector, reporting all matters that in his opinion need correction.

Duties of Sanitary Squads.

II.—Sanitary squads will be divided into groups of about fifteen to twenty men, who will work at the station of the squad commander, in the shop and in the sanitary school. The remainder will be assigned in groups of two or three in each of the small sub-areas. The place in each sub-area at which they are stationed will be so chosen that from it they can patrol the entire area on foot. These men under the direction of a commissioned officer will :—

(1) Keep detail maps of the sub-area, showing everything of sanitary importance, water sources, latrines, urinals, stables, cesspools, dumps, baths, lavoirs, kitchens, billets, barracks, camps, etc.

(2) They will inspect and keep in repair permanent sanitary appliances located in their sub-areas, such as latrine seats, baths, kitchens, etc., drawing upon the sanitary shop of the section for labour and materials.

(3) They will keep in touch with the engineer water personnel working in the sub-area.

(4) They will, as well as possible, keep themselves informed of infectious diseases occurring in the civilian population in the sub-area and see that such disease is promptly reported to the proper medical authorities.

(5) They will furnish all information gathered by them to town majors and commanding officers of incoming troops as soon as they enter the area.

(6) They will report all sanitary defects which require attention to squad commanders of section.

(7) They will plan improvements of permanent sanitary installations and confer with the squad commander regarding them.

(8) They will report upon the condition of sub-area or parts of it whenever troops leave this area.

(9) They will exercise no administrative or other authority, their functions being those of inspection.

(10) Their maps will be kept up-to-date and copies furnished incoming troops and others whose health depends upon such knowledge.

(11) It should be understood that the enlisted men of sanitary squads are not labour troops, i.e., they do not police or care for grounds, billets, and areas, or dispose of refuse. They function as assistants to the sanitary inspector of the 2nd Army.

These arrangements provide an adequate sanitary supervision, which serves the important purposes of keeping constant guard over the area occupied by the army, facilitating the tasks of incoming troops, obviating the necessity of frequent and useless repetition of sanitary surveys of the same territory and keeping the army authorities constantly informed

of prevailing conditions and needs. By constant co-operation with billeting majors and with officers and men of the water service of the engineering department; moreover, these squads form a co-ordinating link which serves to convey necessary information from one service to the other.

When the army area changes by advance or lateral shifting it is a relatively easy matter for the squad commander, whose area is adjacent to the newly acquired territory to extend his work into this. If complete change in the location of the army takes place, the squad commanders concentrate their men at a central point, move them forward and after a rapid survey on their motor cycles, in consultation with the billeting officers of G. I, redistribute personnel. Such a shift should not require more than three or four days at the most, and as a matter of fact, when the system has once been thoroughly established and the personnel trained, the survey of a new area can be carried out with increasingly greater speed.

When the army is engaged in active combat it is best to exclude from the above scheme of organization a strip of territory about four kilometers deep, immediately behind the trench lines. This area is subjected to shell-fire and any kind of constructive activity of a permanent nature is rendered difficult. In this area it is best to leave sanitary work entirely to the divisional authorities, in direct consultation with the army sanitary inspector, who should keep in close personal touch with the divisions in the line.

Relations of the Army Sanitary Office to the Sanitary Inspectors of Divisions.

The army sanitary organization should not interfere in the slightest with the sanitary organization of the several divisions in the army. The routine sanitary supervision of divisional troops in all matter pertaining to health should be left as hitherto, in the hands of division surgeons and division sanitary inspectors. It is the duty of the army sanitary inspector however, and all the machinery at his disposal, to reinforce the divisional facilities, to advise the responsible divisional officers and to place at their disposal the experience and knowledge he may have gathered by reason of his intimate acquaintance with the area. The army sanitary inspector should be a man, not only trained in field sanitation but one who by experience in laboratory and epidemiological work can reinforce the divisional facilities whenever infectious disease of any kind occurs. Whenever infectious disease is reported from divisions in more than isolated, unrelated cases, the army sanitary inspector should confer with the divisional sanitary inspector, examine the prevailing conditions and advise. It is he, who, either in person, or through trained assistants, should make epidemiological studies and laboratory studies whenever these seem indicated for the purpose of arresting the spread of contagion. He should be the adviser of the chief surgeon of the army in matters of sanitary policy, in circularization of information, and in the meeting of any emergency. It is his duty to

organize the area supervision and the transmission of information concerning the areas to incoming divisions. It is his function to establish and maintain liaison between the divisional authorities and other services of the Army which have bearing on sanitary problems, such as the water service of the engineer department and the bathing and disinfestation activities of the quartermaster department.

To carry out these functions, he must have, first, transportation; second, assistants and personnel for area organization; third, a system of report whereby he can keep records of the daily occurrences of communicable disease in all units of the army. His functions, thus defined, do not in any sense curtail the authority or diminish the responsibilities of the divisional medical authorities.

The question of the proper personnel of the army sanitary organization will be tabulated below.

Reports.—It is necessary for the sanitary inspector of an army to keep constantly informed concerning the prevalence of communicable diseases in all troops of the army, both those in divisions and those designated as army troops. For this purpose he must maintain in his office some kind of a reporting system whereby he can constantly keep his hand on the pulse of the sick rate. In working out a system of reporting for active army organizations it should always be borne in mind that unit commanders and medical officers are often over-burdened with paper work, and that the multiplication of such duties may interfere seriously with their more important function, namely, the actual execution of the duties they are asked to report upon. For this reason, whenever outlining a system of report one should scrutinize each report demanded as to whether it is actually one which will furnish information on a basis of which action can be taken. Provision is already made in Army Regulations for routine reports of many kinds, and the routine information which is really needed is constantly passing through the proper sources automatically. What the army sanitary inspector needs to know is whether contagious diseases are occurring, when and where, and in which company units.

The company unit is important because it indicates occurrence in groups which are eating and living together, and therefore this report gives information as to contact. Knowledge of the place where the disease occurs is very important when troops are stationary, less important when they are constantly moving about in an army area. But nevertheless even here the place is of value since the occurrence of a considerable number of cases in one and the same place within a limited period may point to faulty condition of barracks, billets or water-supply. The system which has been worked out and is in use in the 2nd Army is simple and gives the necessary information.

Paragraph 12, Manual of Sick and Wounded Reports, A.E.F., September 15, 1918, provides that special daily telegraphic reports of admitted communicable diseases must be sent to the Chief Surgeon, A.E.F., by all

field, evacuation, camp and base hospitals. Report must give name, rank, company and place of origin of infection whenever possible. For the purposes of the individual Field Army it is sufficient to require duplicate telegrams from all the field and evacuation hospitals in the army and to request similar duplication of telegrams from any base hospitals that are situated so close to the army area that they may receive patients direct from army units without their passing through field and evacuation hospitals. On receipt of these telegrams, an assistant in the office of the sanitary inspector takes them each morning to the statistical office of the army, checks the location of the units from which the diseases were reported, and then lists them and records the information in the following manner:—

(*a*) *Record of Units.*—A book is kept in which separate pages are so lined that cases of epidemic diseases can be entered by date and company, one page being given to each unit in which the disease occurs. An example of such a page is shown on p. 330. The letters in the squares representing the code adopted for the brief designation of different diseases.

(*b*) *Spot-map.*—A wall map of the entire army area is kept, and when an infectious disease occurs a pin is stuck into the location from which the disease is reported, pins with a variety of coloured heads used for different diseases. Each pin is thrust through a little square of paper on which is written the date and the unit. When the area is one of an army actively engaged in combat, in which units are moving to and fro with great rapidity, the knowledge of the place from which the case is reported loses value by virtue of the fact that the disease was probably not contracted in the place from which the report comes, and from the fact that by the time the patient has been in hospital two or three days this unit may have moved to another location. However, the spot-map can nevertheless be made of value by the following procedure. At the end of each week the information found on the spot-map is entered in a book. In this way there is constructed a record of all places in which infectious diseases have occurred during the week. When this information has been entered in the book for the past week the pins are taken out and replaced with common pins (without coloured heads), which are left to form accumulated evidence of all infectious diseases that have occurred in each place. When a large number of such pins accumulate in any single space, it is simple, by going back to the book in which the diseases are kept by places, to find out which particular variety of disease has occurred there. Beginning with the new week, the coloured pins are again entered as before. The map, thus, at all times, shows not only the nature and location of the disease occurring within the week, but also indicates by a massing of the common pins whether or not these places have been frequent sources of disease. After a while it is of value to study the movements of units in which infectious diseases have occurred and draw lines across the maps with red or blue pencil along the paths of movements followed by these

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NOVEMBER 1918

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ORGANIZATION 56 Infantry

November 10 at Bouillonville. November 18 at St. Marie Farm.

Sanitary Inspector's File of Epidemic Diseases by Organization.

Code: Chicken-pox, C.P.; cholera, C.; diphtheria, Di.; dysentery, Dy.; German measles, G.M.; measles, M.; meningitis (c.s.), Men.; paratyphoid fever, P.F.; plague, P. scarlet fever, S.F.; small-pox, S.P.; typhoid fever, T.F.; typhus, T.

The station entered at bottom of each sheet is corrected daily from the revised list of the Statistical Office.

units. This can easily be done by reference to the information in the "unit" and "place" record, and it may occasionally be found that lines drawn for infected units may intersect at places at which a considerable number of infectious diseases have occurred. By putting in dates it may sometimes be discovered that a unit which has reported communicable disease has passed through places from which similar cases were removed from other units, within periods representing incubation times.

As implied in the above, a further record, arranged by places, is kept in an ordinary ledger in such a way that there is a page for every town in which a communicable disease has occurred, and all cases reported from these towns are entered on this page.

To summarize, we then have a cross-indexing of records as follows:—

(1) Record by units from which contact studies can be made.

(2) Map record of places, as described above.

(3) A ledger in which the occurrence of disease is recorded by place of occurrence.

(4) A week-book in which weekly records of the map are preserved after the renewal of pins.

In addition to these records constant contact should be kept with divisional surgeons and sanitary inspectors and medical officers of army troops who are requested to communicate directly with the sanitary inspector of the army when they wish advice on any sanitary matters, or when any of the units under their care show the occurrence of infectious disease which they regard as warranting remedial action. Such an arrangement, especially if the sanitary inspector has the confidence of the officers involved, forms an indispensable check on the records described above, and makes it possible also to keep in touch with the occurrence of diseases which it is unwise to designate as "reportable." Such, for instance, would be influenza. When a few isolated cases of so-called influenza occur they have very little sanitary importance, and reporting them would needlessly encumber the paper work. When influenza occurs as an epidemic, the cases are usually so numerous that telegraphic reports are not feasible. In this disease and a few others, therefore, we must rely on the direct information by contact with the officers in charge, with whose co-operation intensive study of the situation must be made when epidemic conditions prevail.

The activities of an army sanitary department are, in other words, analogous to those of the combat branches. A routine of reliable information must be established on the basis of which the needs of ordinary times can be attended to, but this organization must be sufficiently elastic and possess sufficient reserve margin to detect promptly and to be capable of reacting by special efforts to emergencies or sudden changes that may occur.

LABORATORY AND EPIDEMIOLOGICAL SERVICE.

Just as the laboratory is of partial efficiency only in hospitals if the bacteriologist is unfamiliar with the cases in the wards, so in armies the laboratory service cannot be entirely efficient unless the laboratory officer is trained in, and in touch with, the epidemiological data. For this reason the sanitary inspector of the Army, who should be capable of acting as an adviser to medical officers and sanitary inspectors of the several troop units, should be a man not only trained in practical sanitation but one who at the same time is familiar with the facts of epidemiology, the methods of making epidemiological surveys, and can handle a laboratory for the control of communicable diseases as an important tool of his profession.

The laboratory organization of a Field Army when the army is holding a definite sector should consist of a stationary mobile laboratory within reasonable proximity to army headquarters. This main army laboratory should be equipped for all cultural work, and have a personnel consisting of at least two or three commissioned officers and five enlisted men, three of whom are trained technicians. Attached to this army laboratory there should be one to two mobile laboratory cars equipped as are those now in the A.E.F. or those designed by the British for army use. When the army is moving, as in a rapid advance, or is changing its areas for other reasons, the two mobile laboratories may suffice. Each mobile laboratory should have as personnel, one bacteriologist, one driver and one trained technician. There should be with it a motor cycle which can be used for the collection of specimens and for epidemiological studies. The stationary army laboratory should also be a supply laboratory for the mobile laboratories which proceed from it as a base on special trips.

It is doubtful, at the present time, whether the divisional laboratories as formerly organized and equipped should be continued. When divisions are reasonably stationary, such laboratories can be of great value for the performance of clinical pathological work for field hospitals, and can materially aid in the speed and detection of communicable disease, more particularly meningitis, diphtheria, amœbic dysentery, malaria and tuberculosis. It should never be attempted to equip such a laboratory for extensive laboratory work, for when divisions are moving or actually engaged in combat insuperable transportation difficulties invariably arise. Moreover, under such circumstances, patients who are sick for more than a few days are evacuated to hospitals where laboratory facilities are available, and the largest epidemiological problems can best be handled under any circumstances by the mobile army laboratories described above. The bacteriologist in charge of these cars can be trained by the army sanitary inspector to make epidemiological studies and thus utilized can independently attend to the rapid contact and carrier studies which should be made in direct co-ordination with the actual laboratory work. It is our belief that a thorough laboratory training is essential to work in epidemiology. The

divisional laboratory man should be utilized in the same way as special assistant to the divisional sanitary inspector.

In discussing laboratory work in field armies it should always be borne in mind that an army engaged in combat or holding a sector is not the place for research. The laboratory should be an instrument in the hands of sanitary authorities for the prompt detection and arrest of communicable diseases. For these reasons it is of great import that we should consider briefly the extent of laboratory work which it is wise to carry out in active field armies.

The most practical solution of the clinical pathological problems for divisions would seem to me to maintain a number of such organizations for assignment to divisions when circumstances are such that the laboratory can functionate to advantage. These laboratory units organized as at present could remain under the control of the Director of Laboratories of the army and assigned to divisions for indefinite temporary duty when the respective divisions are at rest, assigned at the request of the division surgeon, and withdrawn and reassigned wherever needed when the particular division is in combat or moving.

It goes without saying that mobile laboratories and all purely diagnostic laboratories which are connected with an army organization should at all times be carefully supervised in order that the promptness of diagnosis which gives the clue to epidemiological investigation and control shall be efficiently carried out.

One of the fundamental principles underlying successful epidemiological laboratory work is to restrict it to the amount which can be accurately done. We are entirely out of sympathy with the extensive carrier examinations which were instituted in the camps of the United States for the control of meningitis upon the occurrence of a single case. Our own observations have not given us the impression that this work has had much effect upon the reduction of the disease incidence and we are absolutely sure that the technical inaccuracies inevitable in such wholesale bacteriology largely defeat the purpose of the work.

It is in our opinion more important to restrict the laboratory work at first to rapid and accurate diagnosis, and to abstain from extensive carrier work until a number of cases have occurred in one and the same unit. The principles of prevention of most of the diseases of importance for army sanitary control are fairly well understood, and after the discovery of a single case in a unit it is more important as a rule to concentrate speedily upon the correction of general sanitary defects for the control of the particular disease. Most all of the important military epidemics are either of respiratory, digestive, or of insect transmission.

For sanitary purposes we consider as respiratory in mode transmission :—

Pneumonia, influenza, measles, scarlet fever, meningitis, diphtheria, mumps, chicken-pox.

Diseases transmitted by the digestive route are :—

Typhoid and paratyphoid fever, the dysenteries, simple diarrhœas.

It is not possible to generalize intelligently when speaking of different diseases. For this reason, the principle of epidemiological and laboratory procedure which we believe sound and effective can best be presented by submitting in more or less detail our reasoning and actual methods of work for each disease in question. Some considerations leading to our method of handling meningitis will be pertinent as illustrating our point of view.

Epidemiologic records show that almost universally in very few instances is one case of meningitis directly referable to a preceding one, as is the case in measles, small-pox, etc. Almost universally divisions that have meningitis show a scattered distribution, there being often as many individuals, or almost as many, involved as there are units, and when the cases are so plentiful that several or many occur in the same company or platoon, it is almost exceptional (though obviously it must occasionally occur) that direct connexion between one case and a preceding one can be established. This shows with great definiteness that in the transmission of meningitis the carrier is of comparatively greater importance than the case.

It also shows that the disease is one to which the susceptibility of individuals varies within very wide margins, otherwise we would frequently find, as in typhoid fever and other diseases, groups of cases radiating back to the same carrier source. This, however, is not the case and it is this that I mean when I say that here is a phenomenon, where the incidence of meningitis is more a susceptibility than a transmission problem.

It will be well for purposes of practical army sanitation to classify disease according to susceptibility phenomena. There are some diseases like typhoid, typhus, small-pox, plague, cholera, measles, scarlatina, and some others to which susceptibility is universal and all individuals who have not had these diseases or have not been artificially protected are likely to contract them if exposed to a sufficient dose of the virus, that is, to a minimum infectious dose. There are other diseases, like pneumonia, in which the normal human being, well-fed, well-clothed and not otherwise diseased is highly resistant and will withstand without harm exposures that will infect promptly his fellows less cared for, or for other reasons in poor physical condition. In the former class the sanitary measures must always primarily consist in contact prevention by the discovery and removal of cases and carriers combined with the supervision of intermediate means of transmission and specific vaccination. In the latter group of diseases the contact matter must of course also be kept in mind, but the primary point of attack must be the general hygienic measures that aim at the prevention of resistance—lowering conditions. In the case of meningitis we are dealing with a disease in which normal resistance is probaby high in most individuals. There exists, however, a group of individuals who for reasons not hitherto clear are abnormally susceptible, this susceptibility being a permanent, perhaps congenital property with them, diminishing

with adolescence in some of them, remaining with others, increasing with all of them when general physical environment is poor. That such diseases as influenza predispose to meningitis is probable, as recent experiences seem to indicate. The supposition that there are individuals who are normally susceptible to meningitis is based on facts observed by all who have dealt with this disease. In all epidemics there are many individuals who are in perfect health and remarkably good physical condition, who develop the disease and die rapidly, while others may harbour meningococci in nose, throat, and even lungs, but escape meningitis. Whether or not such relative immunity depends upon an acquired resistance, whether it is measurable by serum or skin reaction, these are interesting fields for investigation, but too little is known at the present time concerning this to allow us to discuss it.

The carrier problem in meningitis, moreover, differs from that in typhoid fever and some other diseases in important respects. A typhoid carrier is apt to be a chronic carrier. In meningitis it is apparent from the excellent studies of the British and some of our own that carrier rates, in one and the same troop unit, fluctuate between very wide limits. During the warm months, when meningitis incidence is low, the carrier rate is correspondingly low. During the autumn and winter months, coincident with the spread of catarrhal conditions of the upper respiratory passages, the carrier rates go up even to twenty per cent and above.

In the face of these simple facts let us consider how meningitis epidemics come about, why they occur, and in which respect the occurrence of such epidemics differs from those of such diseases as measles, typhoid fever, etc., and other diseases to which all previously uninfected individuals are susceptible.

In any command at any given time there is a definite percentage of susceptibles and there are a number of carriers, varying according to the prevalence of upper respiratory catarrh and degree of crowding of the command. When the command is first organized a few cases of meningitis occur if chance brings these two groups into close association with one another. Sooner or later the command settles down to a more or less regular routine of reciprocal contact between definite groups of individuals associated in fixed platoons and companies, billet or barrack companies. It is summer and there is little catarrhal disease. Men do not spread saliva by sneezing and coughing, and if occasionally they do, the relatively healthy mucous membranes of the recipients do not form a favourable nidus for a flora of organisms so delicately vulnerable to symbiotic conditions as the meningococcus. Cold weather, exposure, etc., come on. Carriers acquire colds and begin to secrete and spread mucus; their meningococci become more plentiful on the diseased mucosæ, and are brought down from the upper places in the nasal sinuses; the men begin to crowd together about stoves and sleeping quarters. Other men similarly diseased become carriers. The carrier rate goes

up and with it the mathematical chances of contact between susceptibles and carriers increase at more than geometrical ratio. Moreover, more men become susceptible because of influenzal or other infections of the nose, throat and bronchi.

With these facts as a basis, how should we handle meningitis in military units? It seems to me utterly useless to attempt to take out all carriers by examining bacteriologically entire regiments or divisions, as has been attempted in the past.

The following circular illustrates the procedure as adopted in the 2nd Army, A.E.F., for the management of meningitis, as based on the preceding considerations.

The following measures should be taken when meningitis occurs in the command:—

(1) When one case of meningitis appears in a unit, make a thorough sanitary inspection of the unit, and enforce with great strictness the existing regulations concerning space between beds, ventilation, and mess-kit washing. Nothing else need be done.

(2) When two or more cases occur within the same ten days or two weeks, in addition to the above, have all men inspected at least once a day, and remove all those with severe colds and coughs from sleeping quarters, screening them from each other with shelter-halves hung between beds, if necessary screening off the part of the barrack in which they are put from the rest of it, preferably putting them together in a separate building. Treat coughs and colds as things requiring the attention of the medical officer as though they were really dangerous sources of infection to others. Other matters of inspection such as cleanliness of floors, spitting, etc., go without saying.

(3) When two or more cases occur in quick succession in such a way that one can reasonably become apprehensive of an incipient epidemic, the following measures should be adopted:—

Carry out strictly all the provisions incorporated in the preceding paragraphs, regard the command as probably badly infected, and take great pains to separate out the coughs and colds. Do your utmost to find facilities for additional quarters, and spread the men out in small groups, or allow as much more space as possible beyond the minimum required. If necessary, put some of the men under tentage or in pup-tents, giving them extra allowances of covering. The argument that this cannot be done in the whole A.E.F. is invalid, because this command is to be managed as an infected one. Have a non-commissioned officer supervise mess-kit washing in boiling water. Inspect quarters during the day as often as seems necessary according to discipline of the command, and, at least, once during the night for ventilation. Notify the office of Chief Surgeon, 2nd Army immediately, so that army laboratory may undertake to do carrier rate examinations on the command. Preventive measures beyond those stated above will depend upon the result of laboratory examinations.

The following Sanitary Order, 2nd Army, A.E.F., will illustrate our opinions as to the proper balance to be struck between the employment of general sanitary measures aud laboratory investigations in the actual control of epidemics in an active field army. The section on meningitis incorporated in the original is omitted to avoid repetition.

REGULATIONS FOR THE CONTROL OF COMMUNICABLE DISEASES, 2ND ARMY, AMERICAN E.F.

The following circular is issued for the guidance of medical officers of the 2nd Army in their most important function—that of preventing communicable disease.

The sense in which the word "quarantine" and "contact" are used is first defined in order to avoid ambiguity.

Definition of Quarantine.—It is impossible to lay down iron-clad rules applicable to all conditions. A certain amount of discretion must be left to the medical officer in charge. In making recommendations, both military necessity and medical expediency must be considered. Military duties and training must be interfered with as little as possible. In making recommendations, it is advisable to put them in such form that they may be issued directly as an order.

Definition of Contacts.—The following will be considered contacts:—

(1) Men in same tent; (2) men in the same room in billet; (3) men in same barracks who have been sleeping within three-bed distance on either side of patient within the last ten days; (4) those men who have been in particularly intimate association with a case during the probable infective period.

Definition of quarantine. Quarantine may be of two degrees: (1) absolute; (2) partial or working quarantine.

(1) Absolute quarantine. Men are strictly confined to a definite area, and all association of any kind with others is forbidden. This is only applied in very serious diseases, such as small-pox, typhus fever, plague, etc., or where the extent and degree of the epidemic warrant strenuous efforts for its control. A guard is usually necessary.

(2) Partial or working quarantine. Troops are allowed to attend out-of-door formations. It is preferable that they be drilled or worked separately, but when this interferes with military training, it need not be insisted upon. When off duty, they are to be kept absolutely separate from others, messing alone, or at a different hour, and washing their mess-kits in separate boiling water. It is the type of quarantine usually employed.

(I) *General Procedure.*

(i) Measures to be taken immediately when respiratory disease occurs. In this category are included pneumonia, influenza, measles, scarlet fever, meningitis, diphtheria, and mumps:

(1) *Quarters.*—Inspect quarters to determine overcrowding. The ideal

to be aimed at is a minimum floor space of four by ten feet per bed. Under no circumstances ever allow less than twenty square feet, and, if this seems impossible of attainment, report immediately to higher sanitary authority (*Bulletin* 94, H.A.E.F., 1918). Make sure that all the available space in your billeting area is in use, and that there are no unoccupied rooms or barracks while others are overcrowded. When the space allowed is less than four by ten feet, hang up shelter-halves between beds by stretching strings from wall to wall. Under all circumstances enforce head to foot sleeping. When double-deck bunks are provided, try to allow five feet between individual bunk units. Separate the two men sleeping on the same tier by shelter-half partitions. Be sure that men across aisles are sleeping head to foot. Not more than fifty men should go into an Adrian barrack. During warm weather shelter tents should be used in preference to crowded barracks. Ventilation must be strictly enforced, and inspections made at least once between taps and reveille to enforce the keeping open of windows. Blankets and bedding will be aired for several hours on dry days. Spitting in quarters will be made subject to disciplinary action. Floors of sleeping quarters will be swept after sprinkling with water once a day.

(2) *Mess-kits.*—Mess-kits must be washed in boiling water. The mess-kit water should be kept on the fire and kept full of soapsuds. Rinse in running water. Do not dry on a common towel. When no fuel is available it is better for the men to wash individually in running water, wiping out with paper or leaves, than to wash in the common lukewarm can of diluted saliva.

(3) Inspect men twice a day, once at roll-call, once at retreat. Look them over for colds in the head, red conjunctivæ, coughs. Ask a few pertinent questions. Take temperatures of men who are not feeling well or who have severe colds. Segregate those with colds and coughs by putting them into separate sleeping quarters. If no such quarters are available separate a part of one barrack or large billet by making a partition of suspended blankets. Hospitalize all the cases with temperature.

(4) Investigate equipment of men with especial attention directed to supply of overcoats, raincoats, serviceable shoes, three blankets per man and three pairs of socks.

(ii) Measures to be taken when intestinal disease appears—typhoid, paratyphoid, dysentery, or epidemic simple diarrhœa.

(1) Inspect latrines. See that they are not too full; that the seats and covers are tight and that there is no trickling where bottom of box fits on the ground. When materials are available have latrines burnt out once a day. Fill up all that are too full and have new ones dug not less than five feet deep. If no lumber is available for covered latrines see that there is a pile of dirt and a shovel on hand and either inspect frequently or put a guard on the latrines to make sure that the men cover every defæcation and soiled paper with dirt. If available, wash woodwork once a day with a solution of cresol, a pint in two buckets of water, and sprinkle residue of

this on fæces. Sprinkle inside of latrine once daily with chloride of lime, if available. If epidemic conditions prevail have wash basin and soap handy and force every man to wash his hands after defæcation. Supply no towels. Hands should be allowed to dry in the air.

(2) Inspect kitchens and enforce cleanliness in the handling and preservation of food. See that meat is protected from flies. Stop the use of salad, fruit, milk or other uncooked food. Enforce the washing of hands of kitchen personnel before the handling of food. In permanent camps, kitchens must be screened. Inspect kitchen personnel and remove those who have intestinal symptoms.

(3) Attend to water supply. Personally assure yourself of proper chlorination of water and the cleaning of carts if water-carts are used. Request bacteriological analysis of sources from which the water is taken after chlorination. If necessary put guards on public water supplies, faucets, etc., and instruct men concerning the dangers of unauthorized sources.

(4) See that garbage, offal, the dead bodies of horses, etc., are promptly buried to reduce fly-breeding. Have manure piles removed, covered or packed tightly.

(iii) Notify commanding officer of organization of existence of an incipient epidemic.

(II) *Special Procedures.*

Sanitary Management of Meningitis.—The following measures should be taken when meningitis occurs in the command:—

(1) When one case of meningitis appears in a unit, make a thorough sanitary inspection of the unit and enforce with great strictness the existing regulations concerning space between beds, ventilation and mess-kit washing. Nothing else need be done.

(2) When two or more cases occur within the same ten days or two weeks, in addition to the above have all men inspected at least once a day and remove all those with severe colds and coughs from sleeping quarters, screening them from each other with shelter-halves hung between beds, if necessary screening off the part of the barracks in which they are put from the rest of it, preferably putting them together in a separate building. Treat coughs and colds as things requiring the attention of the medical officer as though they were really dangerous sources of infection to others. Other matters of inspection, such a cleanliness of floors, spitting, etc., go without saying.

Diphtheria.—On occurrence of a case of diphtheria, contacts will be put under working quarantine and a request made on the chief surgeon of the army for cultural examinations and Shick tests on the contacts and on the kitchen personnel of the unit in which the case has appeared. Carriers will be isolated and re-cultured after a week. Extent of cultural examination beyond this will be determined by the sanitary inspector

after an epidemiological survey. The entire command will be inspected at least once a day for sore throats. Positive Shicks will be given 1,000 units of diphtheria antitoxin. The administration of diphtheria antitoxin, with dates, should be entered on the Service record.

General measures given above, concerning quarters, mess-kits, etc., will be carried out.

Measles.—In addition to the general measures advised above, all contacts will be isolated in working quarantine for two weeks. The most important measure in the limitation of measles is the inspection of men at least twice a day, the prompt segregation of all men with colds or inflamed conjunctivæ, and the prompt hospitalization, as suspects, of all men showing temperature of 99·5 or above, by mouth.

Scarlet Fever.—In addition to general measures a working quarantine of all contacts for two weeks. Inspection as in measles. Especial attention to sore throats and temperature and segregation of those with severe "colds."

Liberty Measles—As in measles.

Mumps.—Working quarantine of all contacts for three weeks. Daily inspection with especial attention to swelling of parotids and submaxillary regions, and inquiry as to sore throats. Temperatures taken on all suspicious cases and men with temperature hospitalized.

Small-pox.—Absolute quarantine of entire unit. Revaccination of entire unit. At least two negative trials must be made. Daily inspection as above and release from quarantine two weeks after completion of revaccination.

Typhoid and Paratyphoid Fever.—(1) Inspection of the command from which the case has come, especially in regard to the water supply, latrines, kitchen and sources of food, etc., as listed above.

(2) Scrutiny of the vaccination records of the entire unit.

(3) Carrier investigation of the kitchen personnel requested.

(4) Attention to fly protection and breeding.

Nothing further will be done beyond the correction of sanitary defects unless a second case occurs in the same unit. When another case occurs in the same unit, repetition of the carrier examination on the kitchen personnel will be made and the entire unit re-vaccinated with one dose of triple lipo-vaccine.

Dysentery.—Same procedure as in typhoid fever with particular attention to fly-breeding, latrines and the protection of food. Kitchen personnel cultured for the carrier state.

Amœbic Dysentery.—Same as above, with particular attention to the discovery of carriers. This problem should be referred to the Army Laboratory through the chief surgeon.

Trench Fever and Typhus Fever.—Cases that suggest these diseases should be immediately reported even if diagnosis is doubtful and measures taken to have entire command deloused immediately. If there is difficulty

in doing this, the problem should be reported to the chief surgeon of the army. If there is a case suspicious of typhus fever the entire command should be put under strict quarantine until satisfactory delousing has been accomplished, and several careful inspections for lousiness have been negative at intervals of one week. Typhus suspects should be evacuated in a separate ambulance, the cases marked as suspicious of the disease and all blankets, clothing, etc., on the patient or in the ambulance must be deloused.

Influenza and Pneumonia.—Principles of prevention. The principles of prevention consist in: Supplying of men with sufficient clothing and covering at night and keeping them as dry as possible. Each man should have three blankets, one suit of heavy underwear, three pairs of socks, two pairs of shoes, one raincoat, one shelter-half, and sweater. The avoidance of crowding in quarters and billets, and the provision of ventilation, as per "General Procedures." Care in the washing of mess tins in boiling water after meals. The prompt exclusion of men with colds in the head from common sleeping quarters and the delayed removal from companies of men showing the first signs of the definite disease. The evacuation of those sick cases separately from wounded and from those with other diseases. Proper care and segregation in hospitals. The first is a quartermaster's problem; the others are medical problems. All are disciplinary problems. *Co-operation is, therefore, necessary and with it suppression of the disease is possible.* These matters must be supervised by systematic inspection.

Dryness.—A wet man invariably is cold, and a cold man is susceptible to infection. Three or four tin stoves in a dug-out or a small hut make an excellent drying-room. Strings and nails in them make it possible for men to hang up their extra clothes to dry. They can then go to bed with dry things or have dry clothes to put on in the morning. A drying-room per platoon or company can easily be arranged with a little ingenuity and is of great sanitary importance, to say nothing of comfort.

Work.—When influenza is spreading rapidly in a command it is wise to remember that when men are overworked to the point of exhaustion they are rendered extremely susceptible to infectious disease. It is advisable, therefore, if military conditions at all permit, to ask that the drill schedule and other work be slightly reduced until the epidemic is under control.

Inspection and Segregation.—When cases of grippe have begun to appear the medical officer should attend roll-call and rapidly *inspect all the men every morning.* This can be done with speed by walking down the line, observing men for signs of "colds in the head," coughing, sneezing, or red eyes, and asking a few questions. Suspicious men should be made to step out and sent to the sick call, where temperature should be taken. Men with definite colds in the head, without temperature, should be taken out of their billets and made to sleep in special barracks or billets, or other

available space, with shelter-halves hung up so as to form screens between neighbouring beds. If possible, they should be given an extra allowance of bed covering. They should be placed on light duty for a day or two. If no special quarters are available for such men, put them all together at one end of the barrack and separate this end from the rest of the barrack by hanging up blankets or in some other way making a screen. Where the military situation will permit cases of influenza may be hospitalized in the divisional area. The attack is shortened and complications prevented by early bed treatment. Ample floor space must be allowed and screening between beds attended to. Gauze masks should be worn by patients and attendants when coming into intimate contact, especially during transfer and evacuation. Cases whose temperature continues for more than forty-eight hours or with signs of pneumonia developing, should be evacuated except from such hospitals as have been designated by the chief surgeon, 2nd Army, as respiratory disease hospitals. On all men showing temperature on first inspection careful chest examination should be made. If any signs pointing to extensive bronchitis or actual pulmonary involvement are found, the patients should be promptly evacuated.

Evacuation.—During evacuation, grippe cases should not be placed in the same ambulance with wounded or with other sick. Remember that in evacuating pneumonia, the greatest care must be taken to *prevent their exerting themselves.* Do not let them walk or dress or undress themselves. Keep them on their backs. Failure to observe this may make the difference between recovery and death.

Hospitalization.—In evacuation and other hospitals, grippe cases must be placed in separate wards. Cases developing pneumonia must be taken out of the grippe wards promptly and placed in separate pneumonia wards. Beds must be screened one from the other. Attendants must wear light gauze masks. Sputum must be disinfected or burned. Thermometers must be sterilized.

The Water Service.

The supervision of the drinking water within the army area falls naturally into a number of phases. There is in the first place the necessity for the prompt discovery of water sources, estimation of probable output of each available source, with a rough sanitary survey of surroundings as indicating the probable degree of pollution. The larger water sources must be located at which it may be useful to establish automatic chlorine sterilization apparatus for the establishment of cart-filling points; provision must be made perhaps for piping of such water supplies. Finally, there must be strict supervision of the quality of water obtained from these sources. The arrangements at the present time authorized for the supervision of water supplies in armies are as follows:—

There is attached to each Field Army a body of engineer troops who are especially assigned to the water service. These troops maintain an

office at army headquarters from which they send out parties of trained engineers and attached sanitary officers to survey as rapidly as possible the entire army area. They rapidly follow up the advancing troops and in the experience of the past summer we have found that this service has functioned very satisfactorily and with promptness and willingness to co-operate with the medical department. The engineers have furnished maps of water points in the areas and by means of this sanitary personnel and attached laboratories have made bacteriological and other examinations of water supplies and have installed Wallace-Tiernan chlorination apparatus both mobile and stationary, at all points where permanent chlorination plants seem to be warranted. It has been possible to transmit this information to divisional sanitary inspectors when divisions moved into new areas, thus relieving them of the necessity of going over the entire ground themselves. This has furnished an important basis for the control of water supply.

Analysis of any water source is of no practical value unless frequently and periodically repeated. For this reason, after the preliminary survey had been made and gross pollution discovered by bacteriological analysis this will be of value in indicating whether or not such a source should be completely excluded, but it is not practical to attempt to control the water supply by periodical laboratory analysis. It is best to assume that all water except that in which the engineering service has established permanent chlorination apparatus is polluted and must be chlorinated in Lyster bags or water carts. This must be surpervised by a sanitary officer attached to the staff of each division surgeon, whose sole function it is to attend to the divisional water supply. It is the duty of this officer to familiarize himself without delay with the records of the water engineers, to mark the locations of water points and engineer installations in his divisional area, to instruct divisional units in the proper use of the hypochlorite of calcium tubes, and Lyster bags and water-carts, and to circulate constantly among the divisional troops, correcting, supervising and enforcing those measures. It is not feasible to furnish such an officer with a laboratory equipment for laboratory analyses, this being both impractical and unnecessary, as indicated above, but he can with profit employ iodide and zinc sulphate solution for the control of proper chlorination, and can teach unit medical officers, mess serjeants and others in the division this method of control. Mess officers also should investigate from time to time whether all divisional units are properly supplied with Lyster bags and whether they are having difficulty in procuring a sufficient supply of calcium hypochlorite tubes.

It is the duty of the army sanitary inspector to keep in his office a complete record of the work of the water engineers on a map furnished by them and constantly kept up-to-date, to see that this information is transmitted to the divisional sanitary inspectors and the medical officers of army units, and to assure himself from time to time that Lyster bags and hypo-

chlorite solution are available and are being used. This he must do by conferring with divisional water officers.

During active combat it often occurs that advancing detachments have no Lyster bags and therefore have difficulty in following our instructions concerning water. When this occurs a number of different makeshifts can be employed and the army sanitary inspector at such times should be in constant touch with divisional water officers to help facilitate their problems by instruction and advice. By a simple calculation, assuming that one gramme of hypochlorite of calcium gives about three parts per million of available chlorine for forty gallons of water and that this gives a sufficient margin for a successful sterilization, within half an hour of anything except highly polluted and iron-containing waters, the fractional addition can be made to containers of any size such as G.I. cans or anything available. When a small detachment is dug in in isolated positions or is moving in such a way that the men are dependent on canteens, the following method can be used: the platoon leader or serjeant can place the contents of a hypochlorite of calcium tube in his canteen and fill this with water. If the hypochlorite of calcium is available only in bulk he can fill the shell of a 45-calibre revolver cartridge with the powder (a volume which represents about one gramme), place this in his canteen and fill it with water. After thoroughly mixing, one teaspoonful of this solution can be put into the canteen of each man. When the canteen is filled with water from any reasonable source it can be assumed that within twenty to thirty minutes the water has been properly sterilized.

Although poison examinations of water have not been found necessary at the present time, it is nevertheless important that some provision be made for the prompt detection of such contamination, when troops are advancing over conquered territory. It is therefore desirable to have one of the standard poison examination chests which are splendid for the gross detection of alkaloids and poisons, in the hands of the divisional sanitary officer, since he is the only trained man who is in touch with the advancing troops. To have these chests in the hands of the water engineers or the corps of army personnel is almost useless.

One of the difficulties encountered in the routine chlorination of water is the occasional failure by lack of foresight or imperfect co-ordination with the quartermaster's department, of units to obtain the needed supply of calcium hypochlorite. It would be best to issue these tubes with the rations. The division should have on hand 7,000 tubes per week, three tubes being issued with every 100 rations. This calculation is based on the allowance of four quarts of water per man per day.

Bathing and Delousing.

It is not our intention to go into details concerning the actual methods of bathing and delousing employed. These must necessarily differ according

to the place where troops are stationed, the numbers to be taken care of and the means available. The question of bathing and delousing is a quartermaster problem, and probably must to a great extent remain in the hands of the quartermaster because of the large amount of property involved. The co-ordination of the quartermaster's department and the medical department in regard to this work has been a difficult problem in the past but can be overcome, as it is being overcome in the 2nd Army by two important arrangements. One of these is to make bathing and delousing an army rather than a divisional function, the other to have in the office of the chief quartermaster an officer who is assigned purely to this and to laundry arrangements. This officer should be trained in the details of delousing procedures and the organization of bathing, delousing and laundry units. He should have a complete record at all times of all the delousing and bathing facilities possessed by the army and have experience in estimating the supplies needed for delousing plants of various sizes and constructions. The sanitary department of the chief surgeon's office advises him as to needs and locations, and helps him in the choice of sites, water sources and general organization.

The most easily organized and foolproof unit for those purposes are those constructed on the basis of a Foden-Thresh steam sterilizer and a converted Adrian barrack. These plants can be rapidly set up whenever an Adrian barrack and a suitable water source is available. They are partially movable and can therefore promptly follow up an advance or adjust themselves to other shifting of territory. Two such plants should be available for every division unless equivalents in the form of other types permanently placed are available. In addition to this every battalion should have a separate bath of at least one LeBlanc eight-shower head unit. Men should be bathed at least once every two weeks and a careful inspection for lice made at every bi-monthly physical inspection. Delousing should be practised as a routine at least once a month when divisions are in the line. When lice are discovered the lousy men should be immediately disinfested, and if possible under the tactical conditions prevailing, the whole company unit should be run through as soon as lice are discovered. This procedure is of vastly greater importance during the cold weather of the fall and winter when trench fever and typhus are apt to prevail and spread most easily. When cases of those diseases appear immediate energetic steps to delouse the command must be taken. This is perhaps one of the most important duties a sanitary inspector can attend to and upon his prompt action under such circumstances may depend the success of military operations.

It is our opinion that frequent inspection for lousiness is a duty the importance of which is not sufficiently emphasized. The early discovery of lice in a command is as important as the early diagnosis is of a communicable disease and at ordinary times, when men are living under reasonably clean conditions lousiness does not spread with great speed.

Early discovery will, therefore, simplify the whole problem. In carrying out the inspection the pubic and axillary hair and the seams of underclothing should be carefully scrutinized and the sanitary inspectors must make sure that medical officers are familiar with the appearance of nits. Too often these inspections are made in perfunctory manner.

Policing of Battlefields.

Under certain conditions of combat, especially during rapid advances of large bodies of troops, the policing of a battlefield becomes a sanitary problem of considerable importance. This is the case more especially in hot weather when the dead bodies of men and animals rapidly become foci for the breeding of myriads of flies, which infest kitchens and mess tents and carry infection from the fæces almost inevitably accumulated in open trenches and in woods where troops have camped for brief periods in the intervals of active fighting. Under such circumstances diarrhœa and dysentery become epidemic and any defects in vaccination in bodies of troops become noticeable by scattered cases of typhoid and paratyphoid fever. It is even possible, indeed we believe that we have some evidence to warrant the assertion, that many cases of mild fevers with intestinal symptoms occurring at such times represent mild attacks of the typhoid and paratyphoid group of disease which are atypical because of vaccination. Our own experience during the Château Thierry offensive, as well as the previous observations of the British and the French, have demonstrated the great importance of the sanitation of the battlefield which in its neglect invariably leads to conditions that may seriously impair man power at a time when it is most needed.

To expect troops themselves to live up to the regulations regarding latrines and refuse disposal during the activities of a battle is not feasible, as experience has shown. It is equally impractical to expect them to police the camps they have occupied perhaps for a single night. The burying of their own dead not only takes away trained men from the fighting units but has a pernicious effect upon the moral at a time when this factor should be carefully nursed. This problem was approached, in the 1st Army Corps, and later in the 2nd Army, by organizing companies of Pioneer troops, either corps or army units for the purpose outlined above. A company is attached to each division in the line. On the night preceding the offensive each company is marched to a position behind the respective divisional line and reports to the sanitary inspector of the division. The liaison and preliminary arrangements are attended to by the army sanitary inspector. These troops then follow in the wake of the advancing infantry, attending to the work above indicated. By dividing them into squads spread across the width of the divisional front, the entire advance can be policed even when the country is thickly wooded as in the Argonne.

The following extract from a 2nd Army order illustrates the system in sufficient detail:—

"(I) Memorandum No. 8, these Headquarters, October 26, 1918, emphasizes several provisions concerning the burial of the dead, which are covered by General Orders Nos. 10, 30, 50, 89, 106, and 122, and Bulletin No. 41, G. H. Q., A.E.F., 1918.

"In order to carry out these provisions and to facilitate the prompt burial of those killed in action, the following arrangements will be made in your corps:—

"'(I) The administrative order pertaining to the field order will direct that one company of Pioneer Infantry or equivalent, with the necessary picks, shovels, ropes, teams and wagons, will be assigned to each combat division. The commanding officer of this company will report this organization in due season to the division sanitary inspector, under whose direction the dead men and animals will be buried.

"'(2) Three chaplains from each division will be detailed for temporary duty with this pioneer company. In addition to their religious duties they will act as burial officers, and secure the effects of the dead and dispose of them in compliance with existing orders.

"'(3) In addition to the duties outlined above, the pioneer company will be used to police the temporary camps of rapidly advancing troops.

"'(4) Upon cessation of an action, and after the duties directed have been performed, the sanitary inspector will request orders returning the pioneer companies to their proper stations.

"'(5) These arrangements for the burial of the dead will be enforced only during and immediately after an action. At all other times the burial of the dead will not be a function of the sanitary service.'"

Respiratory Infection and Evacuation.

During action, especially under circumstances like those which prevailed in the Argonne where many of the men in the line were exposed to wet and cold for long periods, and developed grippe, a problem of evacuation of considerable sanitary importance arises. Efforts must be made to evacuate such respiratory cases separately from the wounded, and especially from the gassed. In both instances, more particularly in the latter, the respiratory cases may transmit to the latter streptococci and pneumococci which may determine the death of the patient. In one division of the 2nd Army it was recently found possible to mask all respiratory cases which came out of the line and keep them masked until admission to hospital.

Reserve Areas of Army when in the Line.

When divisions have been engaged in active combat during which their casualties may have amounted to several thousands, and are then taken

out of the line to an army area for replacements and reserve, their sanitary conditions are apt to sink to a low level if left to their own devices. Men who have lived under combat conditions, who have gone through the harassing weeks of peril and exertion, are physically worn out and mentally strained. They invariably, when withdrawn from the line, relax, both mentally and physically, and it seems poor economy to expect them immediately to take up the routine of camp life and to begin their rest period by cleaning up and policing their new area, digging latrines and in other ways establishing the sanitation of their camps and billeting area. It has happened in the past that such divisions had to be stationed in areas that had been recently abandoned by divisions that have gone forward to take their places, and the consequence was that insanitary conditions with dangers especially great for men in their condition prevailed for a week or ten days, that is, until the division had been brought back to a more or less normal physical and mental state.

It is advisable for the sanitary inspector of the army to make the preparations and the supervision of reserve army areas a part of his activity, to keep in touch with the movements of troops in and out of these areas, and to endeavour with the aid of his sanitary squads to assist in preparing them for the reception of troops coming out of the line. The troops thus finding the areas in good condition are relieved for the first week (which is a difficult one for them) from extensive sanitary policing, and can take up this work themselves by the end of that time.

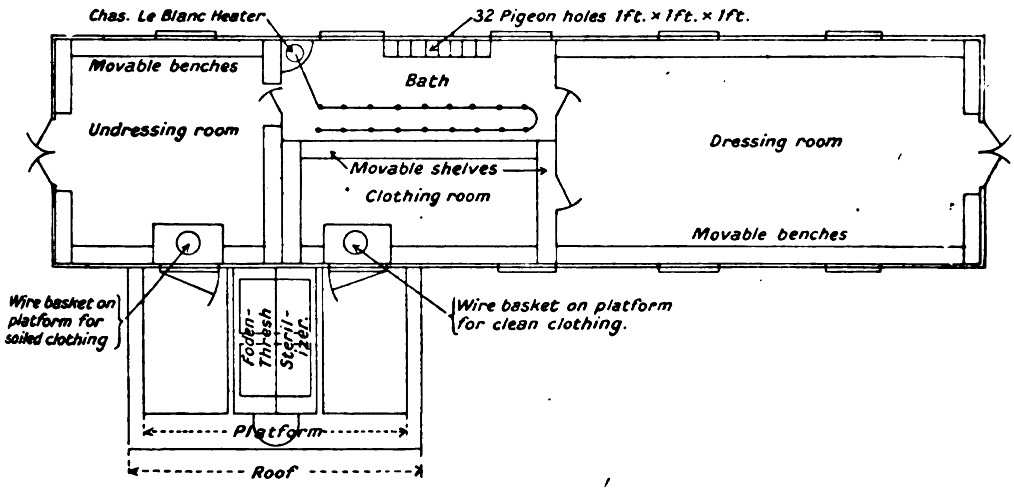
Problem of Replacement Divisions.

One of the important sources of the admission of infectious disease to divisions of an active army is the replacement division. A replacement division is usually located somewhere in the reserve area of an army, and through it pass a large number of casual troops, which after some training and perhaps re-classification and equipment are sent out to divisions in groups varying from a fraction of a platoon to a platoon and larger units to divisions that require replacements. The division, therefore, represents the small end of a funnel through which all kinds of contacts of communicable disease pass from the S.O.S. into the army. Also troops that are held for some time in the replacement camp may there be exposed to disease which may subsequently be scattered by them to many different units throughout the army area.

The replacement division, therefore, is one of the focal points which should have the especial attention of the army sanitary inspector. This division should establish a reception camp in which new arrivals are held until their medical examination can be made before they are turned into the main camp. The sanitary inspector of the replacement division should have special sanitary squads at his own disposal and the laboratory of a replacement division should be more extensive, both in equipment

and personnel, than that of the mobile divisions. Cultural work of all kinds should be possible.

When cases of infectious disease occur in a replacement division prompt epidemiological surveys should be made and measures taken to prevent contacts from being sent to other divisions until the expiration of the incubation time. When cases of infectious diseases occur in the army



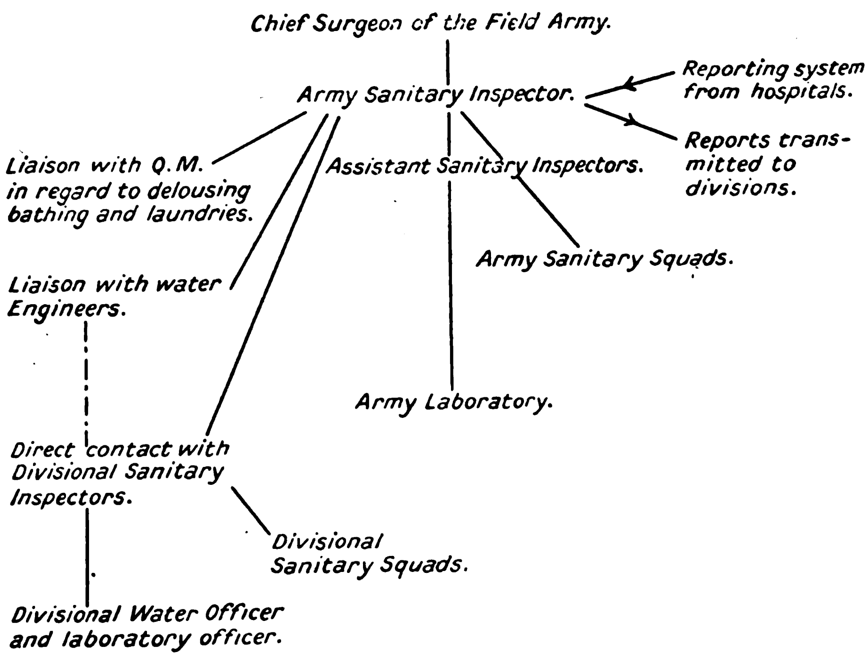
Bathing and Delousing Plant modelled after the one worked out from an ordinary Adrian Barrack by Major Sanford, at Menil-la-Tour.

itself an endeavour should always be made to find out whether the patient or his contacts have been recently added to a unit from the replacement division. In this way it may often be found that the origin of the disease is in the replacement division and that the point of approach for sanitary measures lies in that division rather than in the unit in which the case developed. The sanitary inspector of the army should keep in constant and immediate touch with the office of the chief surgeon of this division.

Alterations in Sanitary Organizations when an Army goes into Rest Area.

When an army is taken out of the line, divisions are usually placed in separate rest areas, which remain definite divisional areas for a more or less prolonged period. These divisional areas may not be in direct contact with each other, there being considerable stretches of unoccupied territory between them. In such a case, the area scheme above described is not feasible unless the personnel of the sanitary inspector of the army be vastly increased. It is best under these circumstances to have the trained army sanitary squads make preliminary surveys of the areas to be occupied by the divisions and to turn over to the divisional sanitary

inspector all information, together with recommendations and advice concerning the establishment of latrines, baths, delousers and other locations, and estimates concerning the amount of construction work to be done. After the division becomes established it will be best to station the available army sanitary personnel at various points from which the divisional areas are accessible and to limit their functions to those of inspecting and advising. The commissioned officers of the army sanitary squads should periodically cover a definite area, should be prepared to assign some of their trained personnel to the service of division, corps or army troops in instructing them in the construction of baths, latrines, incinerators, etc.; they should be on call for special rapid epidemiological surveys for infectious disease as reported from any of the divisions. In this way the chief responsibility of the sanitation of divisional areas remains—as it should—with the divisional authorities, who, however, benefit from the reinforcements by trained army personnel, and from the assistance of men experienced in epidemiological work and the handling of acute outbreaks of disease.



Should there be a Corps Sanitary Inspector?

The sanitary inspector of an army corps can be of great usefulness especially when, as frequently happens, the corps operates as a more or less independent unit. Since, however, the corps is almost entirely a tactical unit, with frequent shifts of location, and with divisions attached

to the corps changing repeatedly, as strategy demands, it is best to have the corps sanitary inspector purely an advisory and inspectorial officer, who is particularly engaged in the supervision of the sanitation of the corps troops and forms a liaison of information between the divisional sanitary inspectors and the sanitary inspector of the army.

Divisional Sanitary Squads.

It seems essential that divisions in the army should retain their sanitary squads, as organized in the past. These two squads of twenty-six men each, under the command of two commissioned officers, should become divisional troops and remain so, whether the army is in action or in rest. They will not in any way interfere with any of the plans described in the above outline; they are so few in number that they represent no important additional encumbrance to transportation nor do they detract or abstract men from the fighting units to any important degree. They are, however, a unit which can be trained and can render highly proficient work in the instruction for sanitary construction and can thus add considerably to the safety of the troops.

The preceding schematic representation summarizes the army sanitary organization.

THE TREATMENT OF MALARIA.

By Major A. CECIL ALPORT.
Royal Army Medical Corps.

The following is part of a paper read at a meeting of the Salonika Medical Society held at the General Hospital on December 19, 1917, and embodies instructions to medical officers in regard to the dosages of quinine and the methods to be used in the treatment of cases of cerebral and other pernicious malarias.

These instructions were issued on October 20, 1917, and the results obtained from this method of treatment have been very successful since that date.

Statistics.

	Number of cases	Deaths
Cerebral malarias in 2,000 cases dealt with in the period immediately *before* the introduction of the "large dose intravenous and intramuscular method" *Mortality fifty-seven per cent*	7	4
Cerebral malarias in 2,000 cases dealt with in the period immediately *after* the introduction of this method *Mortality nil*	13	*Nil*

It will be noted that after the introduction of the method, although the number of cases of cerebral malaria were nearly doubled, the mortality was reduced from fifty-seven per cent to nil.

Instructions to Medical Officers on the Treatment of Malaria.

In all cases of malaria or suspected malaria, immediately the patient is admitted, a blood film must be taken and sent to the laboratory for examination and report. The only exception should be mild recurrent cases which have been under quinine treatment for some time. The routine treatment in all cases is calomel five grains, followed later by mist. alb. and quinine fifteen grains, t.d.s. by mouth. This can be reduced to quinine ten grains, t.d.s., after the temperature has been down for ten days in primary cases, and for a fortnight to a month or more in those who have had repeated relapses.

If the patient is suffering from diarrhœa, castor oil one ounce, with chlorodyne fifteen minims, and brandy ½ ounce, should be substituted for the calomel. All cases with an enlarged or tender spleen should be treated promptly with quinine.

As it is absolutely essential that quinine should be introduced into the circulation at the earliest possible moment, it is obvious that if a patient is not absorbing it by oral administration, other methods must be resorted to; therefore, it must be given intramuscularly or intravenously or by the rectum.

Intramuscular Administration.—Not less than twenty grains of the bihyd. of quinine should be given. The spot selected should be about two inches below the middle of the crest of the ilium. The needle must be introduced perpendicularly, and if the point strikes the bone, it should be withdrawn slightly and the quinine injected into the muscle. Care should be taken not to get any into the subcutaneous tissues, as in that case inflammation and necrosis of the tissues will result. In repeating injections into this region endeavour not to use the same spot twice; keep at least half-an-inch from a previous puncture mark and work backwards towards the sacro-iliac articulation along a line about two inches below the crest. When a large number of injections have to be given, quinine may be introduced into the deltoid muscle at a point about two inches below the acromion process. It is preferable, however, to use the rectal route rather than this site. Instances of musculo-spiral paralysis and sciatic palsies have been reported. These are due to ignorance or carelessness on the part of the operator.

Indications for Intramuscular Administration.—(1) Cases of severe exhaustion, cachexia, anæmia, jaundice and apyrexial malarial infection. (2) Cases where the patient has a thickly-furred or a dry brownish tongue; these cases will not absorb quinine by the mouth. (3) Cases with a temperature of over 104° F. and a dirty tongue. (4) Patients who are vomiting. (5) Any case who appears to be noisy, drowsy, or mentally affected in any way. Medical officers are warned specially against the fallacy of assuming that because the man on admission appears to be mentally dull he was born that way. In the vast majority of cases in the Salonika Command the condition is due to malaria. Such patients should receive at once an intramuscular injection of quinine twenty grains, and the officer commanding Medical Division sent for in case it is necessary to give an intravenous injection as well.

Intravenous Administration.—This is without a doubt the soundest and best method of administering quinine in :—

(*a*) Cases with mental or other nervous symptoms—drowsiness, aphasia, noisiness, nervous twitchings, tendency to get out of bed, etc. It may be laid down as an axiom that any patient suffering from malaria and showing signs of a disturbance of his central nervous system should receive an intravenous injection of quinine at the earliest possible moment.

(*b*) Cases of severe exhaustion, anæmia, cachexia and jaundice with or without a temperature, as well as blackwater fever, and other pernicious types.

Method of Administering Quinine Intravenously.—Accidents have happened after administering quinine by this method, due to one of these causes, viz. :—

(1) An overdose of saline, causing shock and dilatation of the right heart. Post-mortem results in the case of patients who have died of cardiac failure following malaria show the walls of the heart to be thin and fatty

and the muscle atonic. A large quantity of saline forced through the veins into the chambers over-dilates them and the patient collapses and dies.

(2) The injection of quinine in a too concentrated form, e.g., twenty grains, in twenty cubic centimetres of saline. This may cause shock and inhibit the heart's action directly or through the central nervous system, quinine being very destructive to protoplasm already diseased. Experience shows that the best method is to give twenty grains of the bihyd. of quinine in eight ounces of normal saline at a temperature of 110° F. into the median basilic or cephalic vein. This dosage may be repeated three or four times within twelve hours in cases of cerebral malaria who are comatose as well as in other pernicious forms of malaria. In these cases it is often of advantage to use, in addition, the intramuscular and the rectal routes.

Intravenous quinine given as indicated above is quite as safe as any other method of administering the drug. This method is used freely in this hospital with excellent results.

For patients who are collapsed an ounce of brandy may be added to the saline and run with the quinine into the circulation.

Administration per rectum.—When three or four intramusculars have been given into the gluteal region and the patient is still not absorbing his quinine by the mouth, twenty grains quinine in eight ounces of normal saline may be injected very slowly per rectum as an alternative. This is a very valuable method in anæmic and cachectic men who are vomiting and have a soft, weak pulse. If the patient fails to retain the injection, add five minims of tincture of opium to the solution. In some cases it may be necessary to insert a morphia suppository (¼ grain) into the rectum half an hour before the operation.

Cerebral malaria patients who are delirious, restless, sleepless or noisy are greatly benefited by the subcutaneous injection of ¼ grain morphia.

Scale of Doses in Cerebral Malarial Patients.—Twenty grains quinine in each dose in each case. Each injection should be twenty grains of quinine bihydrochloride unless otherwise stated.

On Admission—

1. In early cases showing symptoms of drowsiness, aphasia, nervous twitchings, tendency to get out of bed, etc.	Quinine, sixty to eighty grains in twelve hours. Two intravenous and one or two intramuscular injections.
2. In semi-comatose and delirious cases	Quinine, eighty to one hundred grains in twelve hours. An initial dose of thirty grains in eight ounces of normal saline, with twenty grains intramuscularly, followed later by an intravenous and another intramuscular.

3. In comatose cases ... ... Quinine, 100 to 120 grains in twelve hours. An initial dose of forty grains in eight ounces of normal saline, with twenty grains intramuscularly followed by an intravenous and an intramuscular, and later by a further intravenous or intramuscular—both if necessary.

After-Treatment.—On second day, two intravenous injections and one intramuscular. On third day one intravenous and two intramuscular. On the days following, give intravenous, intramuscular, or injections per rectum as required.

The after-treatment, of course, depends upon the progress made. As soon as the patient is mentally clear, and his other nervous symptoms have disappeared, all injections should be stopped, and quinine, fifteen grains t.d.s. by the mouth, commenced. It should be remembered, however, that it is useless to start oral quinine unless: (*a*) His bowels are acting well; (*b*) his tongue is clean and moist.

The underlying principle of this "large dose intravenous and intramuscular" method of treatment is to make an immediate and direct attack on the parasite in the blood by means of the intravenous, and to continue the effect by means of the intramuscular, which is slowly absorbed over a period of from one to eight hours.

Case of Cerebral Malaria.

Serjt. G., admitted October 22, 1917, at 11 a.m., Regimental number 15170, aged 31. Service, three years; in Balkans, one year eleven months. *Previous History:*—

Notes from the —th Field Ambulance: "Patient complains of pain in back of head; vomiting; ill for six days, first attack; jaundiced; liquid motions for last few days."

Notes from —th Casualty Clearing Station: "No malaria previously; very asthenic; skin, icteric tinge; spleen, plus and tender; urine, *nil.*"

On Admission: Comatose, placed on the D.I. List. Temperature normal; pulse 88, regular and fairly good; no speech, only response to questions is a slow opening of eyes; conjunctival and corneal reflexes present; pupils do not react to light; skin, icteric tinge; heart sounds, muffled; spleen, plus.

First Blood-film.—Malignant tertian rings and crescents, heavy infection.

Progress.—11.30 a.m.: Slight response to needle-prick when giving intravenous, some improvement following. 2 p.m.: Improved, responds better to request to put out tongue; tongue very dirty and dry; pulse better; no Kernig's sign, knee-jerks difficult to obtain, slight ankle clonus, plantar

reflexes flexor. 6 p.m.: Pulse 99, temperature 100° F., patient about the same; 11 p.m.: Still quite drowsy; slight response to stimuli; unable to swallow.

Treatment.—October 22, 1917.—11 a.m.: Intramuscular quinine, 20 grains. 11.30 a.m.: Intravenous quinine, 20 grains in normal saline (10 ounces). 3 p.m.: Intravenous quinine, 20 grains in normal saline (10 ounces). 6 p.m.: Intramuscular quinine, 20 grains. 11.30 p.m.: Intramuscular quinine, 20 grains.

October 23, 1917.—10 a.m.: Temperature 101·6° F., pulse 116, patient improving, makes efforts at speech, taking a little fluid nourishment. 6 p.m.: Temperature 102·6° F., pulse better, tongue very dirty.

Treatment.—11 a.m.: Intravenous quinine, 20 grains in normal saline (8 ounces). 6 p.m.: Intravenous quinine, 20 grains in normal saline (8 ounces). 11 p.m.: Intravenous quinine, 20 grains in normal saline (8 ounces).

October 24, 1917.—10 a.m.: Patient much better, still drowsy, taking nourishment well and is able to speak. 6 p.m.: Temperature normal, improvement.

Treatment.—11 a.m.: Intramuscular quinine, 20 grains. 7 p.m.: Intramuscular quinine, 20 grains.

October 25, 1917.—Patient better in every way, taking nourishment well.

Treatment.—10.30 a.m.: Intramuscular quinine, 20 grains, and quinine, 20 grains, t.d.s. by mouth commenced.

October 26, 1917.—Temperature rose to 100·2° F., but patient feels quite well.

Treatment.—Quinine, 15 grains t.d.s. by mouth.

October 27, 1917.—Temperature normal, patient improving and takes his quinine, 15 grains t.d.s. well by mouth. October 28: Temperature normal, making good progress.

Treatment.—Intramuscular quinine, 20 grains, given to prevent another rise of temperature, and quinine, 15 grains t.d.s. by mouth continued.

October 29, 1917: Improvement continues.

Treatment.—Quinine, 45 grains daily.

November 6, 1917.—"Up" to-day; evening temperature 99° F. November 13: Some pain in left hip at seat of intramuscular injections, no redness nor signs of sepsis.

Treatment.—November 15, 1917: Quinine reduced to 30 grains daily.

November 16, 1917.—Pain gone from hip, patient doing excellently.

November 17, 1917.—*Second Blood-film.*—Malignant tertian, young trophozoites. Patient discharged to a convalescent depot; appearance, full-blooded. He stated he had never felt better in his life.

Comments on the Case.

(1) This patient was comatose for two days, during which time he states he is unable to remember anything that happened.

(2) Although comatose on the day of admission to this hospital, his temperature was normal, and his pulse regular and fairly good, rate 88 per minute.

(3) The rise of temperature on October 26, 1917, was probably due to his not absorbing the quinine by the mouth. Unfortunately there is no note in regard to the condition of the tongue on that date.

(4) The presence of the young trophozoites in his blood, notwithstanding the amount of quinine he had had, and the fact that he had no relapse at all, indicates that a heavy infection by the malignant tertian parasites requires a prolonged course of treatment by fairly large doses of quinine (thirty to forty-five grains a day). The absence of a relapse shows that the quinine taken had neutralized the toxin which causes the fever.

A further extensive dosage with quinine, and a change to another climate would be required to effect a cure in this case.

Résumé of the Treatment.

Patient received 100 grains of quinine intramuscularly and intravenously within the space of twelve hours of the first day. He had 160 grains of quinine, five intravenous and three intramuscular, in the course of the first thirty-six hours. The total amount of quinine absorbed by him in fifty-six days was 1,880 grains; daily average equals 34 grains.

General Remarks.

The intravenous and intramuscular method, with slight modification of the dosages to suit the particular case, has been used with unqualified success in cases of blackwater fever and other pernicious types of malaria.

I repeat here a statement I made at two consecutive meetings of the Salonika Medical Society: "In my opinion no man should die of uncomplicated malaria."

It is perhaps unwise to be too dogmatic, but the success that has been obtained by this large dose method in almost every type of malaria is so striking that it is almost impossible to be otherwise. Moreover quinine given in this manner, I suggest, is so safe that there is never any necessity to hesitate in using it. Should a patient have an idiosyncrasy towards quinine, and become blind (quinine amblyopia) after receiving, say, 100 grains within twelve hours, stop the quinine at once and substitute ordinary rectal salines and subcutaneous injections of strychnine ($\frac{1}{60}$ grain) four-hourly. The vision will return in the course of a few hours and become completely normal. On recommencing the quinine, give smaller doses, forty to sixty grains a day, and continue the strychnine.

In an experience of over 10,000 cases, and well over 100 intravenous injections given as advocated above, only one case of quinine amblyopia occurred.

This occurred on December 24, 1917, in a man suffering from very intense blackwater fever, who received sixty grains intravenously and twenty grains intramuscularly in twelve hours. His sight returned in four hours, and although he has been on fifteen grains of quinine t.d.s. ever since, his sight is perfectly normal. He has recovered from the blackwater fever and is walking about and feels perfectly fit.

Even in malaria, complicated by a condition such as pneumonia, if quinine is pushed vigorously (sixty grains a day until the temperature has remained normal for a couple of days), the patient will recover in the vast majority of cases.

It appears to me that the method of administering quinine and the dosages in the treatment of malaria should be standardized.

No medical man should be allowed to experiment with insufficient amounts of quinine, thereby endangering the lives of his patients.

I am endeavouring at the present moment to arrive at a standard of dosages which will be applicable to every condition caused by the parasites of malaria. I hope to be able to collect and publish in the near future a mass of facts which will go far to vindicate my attitude in respect of malarial mortality, and to confirm my opinions in regard to the treatment of malaria.

Quinine Treatment in Chronic Malaria.

The only quinine statistics here available at present are those of seventy-seven hospital ship cases who were in this hospital for two or three months awaiting embarkation. Of these there are two series, A and B:—

(*A*) Fifty-one cases (treated in one set of marquees).

(*B*) Twenty-six cases (treated in another set of marquees).

Series A.—Quinine statistics in regard to this series are unfortunately of little use, because the quinine issue for twenty-seven days was irregular, and it is impossible to say how much quinine these men really had. The result was that during the time there were fourteen relapses. The average period between the time the treatment was started—which consisted of quinine, one to ten grains a day—and the relapse was fifteen days.

Series B.—The figures given on next page are absolutely accurate.

Average dosage of quinine a day, thirty-five grains; average number of days quinine was given, seventy-one.

Comments.—Two relapses only in this series:—

(1) McC. Blood-film negative; relapsed on December 13, 1917, after taking 2,500 grains in seventy-six days; average thirty-three grains a day. When he left this hospital on December 18, 1917, his spleen was still enlarged and tender. I received a letter from him on January 22, 1918, from Malta, saying that he had had no quinine since leaving Salonika; relapsed two days after reaching Malta, and received three intravenous injections of quinine. I am of opinion that a daily ration of quinine,

thirty grains, continued for a couple of months after leaving this hospital, might have prevented a relapse sufficiently severe to necessitate intravenous injections of quinine.

Name	Blood-film	Number of grains of quinine	Number of days treated
Pte. W.	Malignant tertian	1,680	42
„ G.	„ „	2,640	71
„ M.	Negative	2,520	74
„ S.	No slide	1,940	50
Serjt. G.	Malignant tertian	1,880	56
Pte. M.	No slide	2,940	75
„ P.	Mononuclear increase	2,400	74
„ Mc.	Negative	2,730	81
„ M.	Malignant tertian	3,400	91
„ T.	Mononuclear increase	2,450	80
Cpl. D.	Negative	2,480	72
Pte. K.	„	2,520	76
„ H.	No slide	2,220	57
„ R.	Type undetermined	3,560	91
„ W.	Malignant tertian	2,170	68
„ D.	„ „	1,330	31
„ H.	Negative	1,930	54
„ G.	Benign tertian	2,530	74
„ Y.	Malignant tertian	2,880	82
Cpl. B.	Type undetermined	3,000	91
Pte. B.	Mononuclear increase	2,340	64
„ H.	„ „	3,310	94
„ E.	„ „	2,760	78
„ B.	„ „	1,440	68
„ C.	Negative	2,630	77
„ M.	Mononuclear increase	2,700	80

(2) R. Blood-film, "type undetermined"; very slight relapse on December 12, 1917. This was a very cold day. His temperature rose to 101° F., but he had no rigour. It is questionable whether this is a pukka relapse, it occurred after the patient had taken 3,350 grains in eighty-seven days; average, thirty-eight grains a day.

Blood-films were taken in all these cases on the day before they were discharged (December 17, 1917). Two were positive, but neither of these had relapsed :—

(1) Serjt. G. Blood-film, malignant tertian, young trophozoites. This was after taking 1,880 grains in fifty-six days; average, thirty-four grains daily.

(2) Pte. M. Blood-film, malignant tertian gametes. This was after taking 3,400 grains in ninety-one days; average, thirty-eight grains a day.

It is interesting to note that although both these men had parasites in the peripheral circulation, the quinine they had taken prevented them from relapsing.

To sum up, it may be concluded :—

(1) That the successful treatment of malaria, either in the acute or chronic stage, depends upon the amount of quinine given and the method used to assure its absorption.

(2) That the malignant tertian type, being less amenable to treatment, requires larger doses and a longer course of quinine treatment than other varieties.

(3) That the state of the spleen (seen post mortem) makes it very evident that this condition will not clear up without vigorous and prolonged quinine treatment.

(4) That it is necessary to saturate the system with quinine in order to have a sufficient quantity of the drug ready in the circulation : (*a*) To kill the young trophozoites, young schizonts and merozoites whenever sporulation takes place; this also reduces the crescents by preventing their formation; (*b*) To neutralize the toxins.

(5) That while the malarial parasite causes great blood destruction, the hæmolytic effect of quinine is negligible. It should be noted that blackwater fever occurs only in malarial countries and in malarial subjects. And that although quinine may cause transitory hæmoglobinuria in patients who have an idiosyncrasy towards quinine, in the same way that it causes a rash, still the condition is so rare that it is scarcely worth considering. I have failed to find evidence of a deleterious effect either on the leucocytes or the red blood corpuscles in any case treated with the large doses of quinine advocated.

(6) That if malarial patients were treated vigorously with quinine in the early stage of the disease, no lives would be lost, and the percentage of chronic malarias with anæmia and enlarged spleens requiring prolonged courses of treatment with quinine, arsenic and galyl, would be reduced to within reasonable limits.

ON THE ALLOCATION TO THEIR TYPES OF SEVERAL STRAINS OF MENINGOCOCCI BY THE AGGLUTINATION METHOD.

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AND
M. LUDLOW-HEWITT.

Introduction.

During the past fifteen months several strains of meningococci from undoubted cases of cerebrospinal fever in soldiers and civilians have been isolated, and thereafter kept in culture in the Pathological Department of the Radcliffe Infirmary, Oxford.

Our thecal strains appear to have originated from various neighbouring regions where small epidemics may exist, or from endemic sources, and therefore to show great variety of type. In allocating some of these strains to their types by the agglutination method, difficulties at once presented themselves. Some of these have been removed by experience and a nearer adhesion to the directions issued with the standard outfit from the Central Cerebrospinal Fever Laboratory. Other difficulties arose when we prepared anti-sera for some of the strains in order to place them by the agglutinating properties of these sera. We propose here to submit the anomalous results obtained.

One frequent cause of failure to obtain any agglutination beyond traces, when putting up an emulsion of one of our strains against the four-standard type sera, was that the home-made coccus emulsion was much less sensitive than the type emulsions sent out by the Central Cerebrospinal Fever Laboratory, and failed to agglutinate to a satisfactory degree with any of the type sera in so high a dilution as 1 in 100. The "directions" give warning against placing any reliance on readings or titre below 1 in 100 serum, on account of certain Gram-negative cocci other than meningococci having been found to be agglutinable by these sera in low dilutions.

For many months, therefore, we did not venture to use the type sera in titres below 1 in 100 for fear of obtaining misleading results. We imagined, and perhaps others have too, that if the four type sera give complete agglutination with their respective type coccus emulsions in the controls used to ascertain if sera and emulsions are still in working order, even only in titres 1 in 100 or 1 in 200, the emulsion of coccus being tested might naturally be expected to do the same, if it belonged to one of the four meningococcus types. It was only after experience to the contrary that we realized that the sensitiveness of the home-made coccus

emulsion may fall far short of that of the standard type emulsions, and that it is only when the four type sera are still at the height of their powers that the average home-made meningococcus emulsion may be relied upon to show complete agglutination with a titre of 1 in 100 upwards of any of the type sera.

We have latterly put up some of our meningococcus emulsions against the type sera in titres below 1 in 100 and found that with these greater concentrations of serum the agglutination of one strain of meningococcus with several type sera might be a cause of confusion. This experience led us to attempt to ascertain the types of some of our cocci by animal inoculation, with results which show in certain cases apparent alteration in type. A similar result was obtained when two of our strains were inoculated into human beings.

We have not ventured to distinguish these types by means of the method of absorption of agglutinin, because, until we could understand or control the variation in agglutination, we were hardly likely to obtain results of value by a more complicated method.

It should be understood that we have no desire to impugn the essential practical value of Lieutenant-Colonel Gordon's method of agglutination in its application to the identification of epidemic strains of meningococci. Our main object is to draw attention to the fact that insensitiveness of a meningococcus emulsion, from whatever cause, may lead to its failure to be recognized by the routine agglutination method, and also to show that agglutinating sera prepared by animal inoculation may give anomalous results when tested against the four standard type emulsions.

Method of Putting up Agglutination Experiments.

The agglutination experiments were put up according to the directions issued by the Central Cerebrospinal Fever Laboratory with the following differences:—

(1) The drop method of Professor Dreyer, modified to suit the circumstances, was used throughout. The advantage of this method is that only one dilution of each serum is necessary for use over a wide range of titres, instead of a separate dilution of serum having to be made up for each titre to be tested.

(2) Heating for twenty-four hours at 55° C. was effected in a water bath and it was therefore unnecessary to plug the tubes.

(3) Neither were they sterilized, as we were unable to apprehend the reason for this precaution, especially as no instructions are given for sterilizing the measuring pipettes.

(4) The 0·5 per cent phenol was added to the 0·85 per cent saline used for making the emulsion, instead of adding it after the emulsion had been standardized. We were unable to discover that this had any injurious effect upon the agglutinability of the emulsions, and it saved a good deal of trouble. Slides stained by Claudius's method were invariably made to

test the emulsion for purity, and every agglutination experiment to be referred to was made with a pure emulsion of coccus. Full controls of type sera and type cocci were invariably set up with each experiment.

(5) As regards the standardization of the opacity of the emulsions, at first we used Lieutenant-Colonel Gordon's method given in the "directions," but we found it impossible to decide when the point of "only just—but still definitely—turbid by daylight" was reached. One appeared to be able to go on diluting indefinitely and still to be able to detect a difference compared with the control tube of tap water. We therefore gave this up and endeavoured, by comparing a little test-tubeful of each, to make our emulsion match in opacity one of the standard type emulsions. This rough method gave more consistent results than the prescribed one, but we have now adopted a very much more accurate method in use in the Oxford University Pathological Laboratory.

After twenty-four hours' incubation the results were read off directly the stand of tubes was taken out of the water bath.

The Strains of Meningococci isolated.

The following strains of meningococci have been isolated by us during the past fifteen months and kept in culture (see Appendix I for details of the cases from which they were obtained):—

Name of strain	Date of isolation	Provisional allocation of type	Sugar tests		
			Glucose	Maltose	Saccharose
Thecal strain "W"	2.1.17	Type II ..	..	..	..
,, ,, "G"	18.2.17	,, III ..	+	+	—
,, ,, "M"	1.3.17	,, I ..	+	+	—
,, ,, "L" (1) ..	22.3.17	,, IV ..	+	+	—
,, ,, "C"	15.4.17	,, IV (?) ..	+	+	—
Pharyngeal strain "L" (2)..	10.5.17	Types II and IV or Type III	+	+	—
Thecal strain "D"	17.5.17	Type III ..	+	+	—

The following two strains were obtained from elsewhere:—

Name of strain	Date of isolation	Provisional allocation of type	Sugar tests		
			Glucose	Maltose	Saccharose
Strain "P" (5)	(Obtained on) 30.6.17 (from Millbank)	Type IV ..	+	+	—
Thecal strain "E"	4.2.18 (from Reading)	Types II and IV	+	+	—

All the thecal strains were isolated in pure culture from the cerebrospinal fluid, and none of them have been contaminated since. The pharyngeal strain "L" (2) was obtained contaminated, as, in our

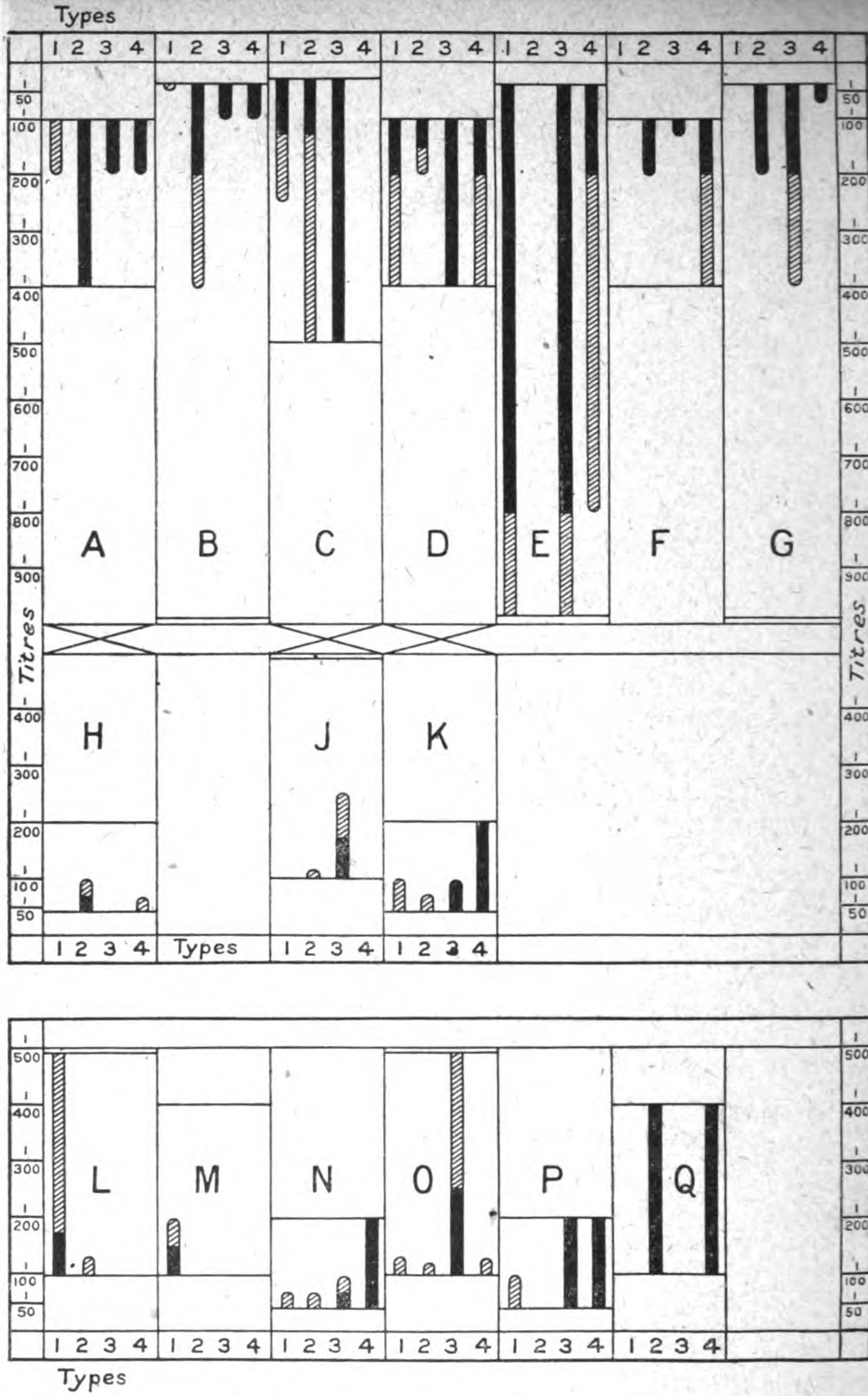

FIG. 1.—To show the agglutination reactions of the immunized rabbit sera against the Central Cerebrospinal Fever Laboratory type cocci, and those of the immunizing and other cocci against the type sera. A and B are the results obtained with different batches of type cocci for the serum of a rabbit immunized with thecal Strain "W," Type II; C, serum of a rabbit immunized with thecal Strain "G," Type III; D and E are different batches of type cocci against the serum of a rabbit immunized with thecal Strain "C," Type IV (?); F and G, different batches of type cocci against the serum of a rabbit immunized with the pharyngeal Strain "L" (2), Types II and IV or Type III; H, J and K, the Strains "W," "G" and "C" respectively against the Central Laboratory type sera; L and M, two different emulsions of the thecal Strain "M," Type I, against the type sera; N is thecal Strain "L" (1), Type IV; O, the thecal Strain "D," Type III; P, Strain "P" (5), Type IV; and Q, thecal Strain "E," Types II and IV, all against type sera. All the necessary controls were done in each case and gave negative readings. The black columns indicate total or nearly total agglutination, the cross-hatched portions incomplete agglutination.

experience, is almost invariably the case with pharyngeal Gram-negative cocci. It was purified, and has since remained pure.

The results of the routine agglutination experiments to determine the type by putting up an emulsion of the coccus against the four type sera are given in fig. 1.

Rabbit Inoculation.

As, in the early part of our investigations, we failed repeatedly to allocate our thecal strains of meningococci to their types by the routine method, we inoculated five of them into young rabbits, using Lieut.-Colonel Gordon's method of preparing high-titre agglutinating sera for meningococcus strains in a short period. The method of making the inoculations was as follows: Young rabbits weighing about 1,000 grammes were used. The emulsions of coccus were made up with phenol saline in the way described above (p. 362). They were standardized by Lieut.-Colonel Gordon's method. All growths used and the emulsions were ascertained to be pure by making Claudius slides.

Four rabbits received intravenous injections of four of our strains of coccus, viz.: Strain "W" (Type II), Strain "C" (Type IV ?), Strain "L" (1), (Type IV), and pharyngeal Strain "L" (2) (Types II and IV or Type III), in the following doses: First day, 500 millions approximately (the rabbit inoculated with Strain "L" (1) died before it could be bled); second day, 1,000 millions approximately; eighth day, 3,000 millions approximately; ninth day bled.

The fifth rabbit, which was inoculated with thecal Strain "G" (Type III), received the following: First day, 1,000 millions 11 a.m., 1,000 millions 6 p.m.; seventh day 2,000 millions; tenth day bled.

The blood was allowed to clot in the tubes and the serum drawn off as soon as separated, and kept in a refrigerator. The sera obtained were all put up in various dilutions against the four type coccus emulsions (Central Cerebrospinal Fever Laboratory). The resulting agglutinations are given in fig. 1.

The feature which most strikes one is not so much which type of coccus was agglutinated, but *which type of coccus was not agglutinated.* All four rabbit sera showed fairly strong agglutinating powers for three types of cocci, but more or less completely left out the fourth. All four sera agglutinated Type III coccus emulsion to different titres.

Thecal strain "G" rabbit serum ..	Left out Type IV ..	Agglutinated Type III to 1 in 500 ..	(Highest tried)
Thecal strain "C" rabbit serum ..	,, ,, II ..	,, ,, III ,, 1 ,, 1,000 ..	(Partial agglutination)
Thecal strain "W" rabbit serum ..	,, ,, I ..	,, ,, III ,, 1 ,, 200 ..	—
Pharyngeal strain "L" (2) rabbit serum	,, ,, I ..	,, ,, III ,, 1 ,, 400 ..	(Partial agglutination)

The sera obtained from the rabbits treated with strains "C," "W," and "L" (2) were each put up on a second occasion against another batch of type coccus emulsions (Central Cerebrospinal Fluid Laboratory). The results are also shown in fig. 1. It will be seen on comparing this second set of agglutinations with the first, that there are some striking differences in the results obtained.

It must be remembered that our object in inoculating these rabbits with some of our meningococcus strains was to obtain high-titre sera which would enable us to allocate them to their types. As each resulting serum agglutinated three types of cocci, the only way of deciding between the rival claims of these types was to award the strain to that type whose coccus was agglutinated by the rabbit serum in the highest dilution.

We are told in the "directions" referring to the group agglutinins that "in these univalent sera, however, the group agglutinins are always present to a less degree than the specific type agglutinin." We might expect therefore that the same would also hold good for our rabbit sera prepared by the same method. As the result of our first agglutination experiments with these sera we were thus led to allocate the strains as follows (also see Diagram I): Thecal strain "G," Type III; thecal strain "C," Type III; thecal strain "W," Type II; pharyngeal strain "L" (2), Type IV. But as the result of the second set of agglutinations of rabbit sera "C," "W" and "L" (2) against another batch of type coccus emulsions, we see that strain "C" agglutinated Types I and III equally, strain "W" retained its preference for Type II, and strain "L" (2) changed its allegiance from Type IV to Type III (see fig. 1).

These sera have lately been put up a third time against another set of four type coccus emulsions; in this case serum strain "W" was the only one to remain constant.

Finally, comparing these readings obtained by means of inoculated rabbits' sera with those obtained by the ordinary routine coccus emulsion method, we may provisionally allocate our strains as follows:—

	By emulsion method	By rabbit serum method
Thecal strain "W" ..	Type II by one experiment ..	Type II by two experiments
,, ,, "G" ..	,, III ,, ,, ,, ..	,, III by one experiment
,, ,, "M" ..	,, I ,, two experiments ..	—
,, ,, "L" (1) ..	,, IV ,, one experiment ..	—
,, ,, "C" ..	,, IV ,, two experiments ..	,, III, first experiment; Types I and III, second experiment
Pharyngeal strain "L" (2)	No successful experiment ..	,, IV by first experiment; Type III by second experiment
Thecal strain "D" ..	Type III by one experiment ..	—
Strain "P" (5)	,, IV and III by one experiment	—
Thecal strain "E" ..	,, II and IV by one experiment	—

INOCULATION OF FOUR HUMAN SUBJECTS, EACH WITH ONE OF FOUR DIFFERENT TYPES OF MENINGOCOCCUS EMULSIONS.

The inoculation of four human subjects, each with one type of meningococcus, was primarily undertaken to see whether agglutinins could easily be produced, with a view to its possible prophylactic value. When it seemed to appear that small doses (50 to 2,000 millions) had no such effect, larger doses (10,000 to 30,000 millions) were tried in order to see if they would produce agglutinins.

The method used in making the inoculations was as follows: Emulsions were prepared from four of our strains of meningococci, namely, strain "M" (Type I), strain "W" (Type II), strain "G" (Type III), and strain "P" (5) Type (IV). The sources of these strains are stated in Appendix I. Growths on trypagar plates of twenty-four to forty-eight hours were used; these were tested for purity and made up with phenol saline, heated to 65° C. and estimated by Lieutenant-Colonel Gordon's method, as near as might be, for bacterial content. The inoculations were made subcutaneously into the upper arm. A dose of approximately 50 millions was used first and gradually increased. Samples of blood were taken every few days, and in every case the sera were put up for agglutination, in different dilutions, against the four standard type emulsions, and on several occasions also against the homologous coccus emulsion which had been used for inoculating.

For details of the doses used and bleedings see Appendix II. After each of the four subjects had received doses up to at least 1,000 millions without producing any measurable amount of agglutinins in their sera, we decided to make up a fresh batch of emulsions, since there was the possibility that those used up to this time might have been impaired by longer heating at 65° C. than the usual half hour, an accidental contamination having made this proceeding necessary.

Inoculations of approximately 500 millions were used first with this new batch of emulsions, and doses of up to 30,000 millions were given to one subject (M. L.-H.) and up to 20,000 millions to another (A. G. G.). The other two subjects (M. E. M. and A. C.) only received up to 10,000 and 5,000 million respectively of the strains used, namely, strain "W" (T ii) and strain "P" (5) (T iv), and in them no positive agglutinating with any of the four standard type coccus emulsions or with their homologous coccus emulsions were recorded at all. For this reason we have omitted their agglutination readings in Appendix II, although their sera were tested on frequent occasions both before, during and after the series of inoculations. However, the absence of agglutinin reaction does not imply absence of other reaction, for both these subjects had had marked general symptoms after one or more of the injections.

The agglutination readings of the other two subjects (A. G. G. and M. L.-H.) are given in Appendix II in full, from the date when positive

readings first appeared. The serum of the one (A. G. G.) who had been inoculated with a Type III coccus first gave a positive agglutination reading twenty-seven days after the second series of inoculations when the second batch of emulsions began. The last occasion on which the serum had been tested before this was the eighteenth day after the same event. After the first appearance of positive agglutination, positive readings were obtained on every occasion on which the serum was tested; but although the subject had been inoculated with a *Type III coccus emulsion,* the agglutination reaction took place almost exclusively between *Type IV standard coccus emulsion and his serum* in different dilutions, and mere traces of agglutination only were recorded between his serum and the other three type coccus emulsions.

It is worthy of note that this strain "G" coccus when inoculated into a rabbit produced an agglutinating serum, which reacted with a four-type coccus emulsion in the following manner. Types I and II gave readings (T) and (T-) respectively up to titre 1 in 125, Type III gave (T) up to 1 in 500 (highest dilution tried), and there was a complete absence of agglutination with Type IV standard coccus emulsion (from titre 1 in 25 to 1 in 500). (See fig. 1.) It is therefore all the more remarkable that when inoculated into a human subject it should produce agglutinin for the Type IV coccus emulsion in preference to the other three types.

Subject M. L-H., inoculated with Type I coccus, first gave a positive agglutination reading (neglecting mere traces) fifty days after the second series of inoculations began and twenty-eight days after the first much larger doses of 20,000 millions. There was a certain amount of agglutination on this occasion with all four of the type emulsions, but most with Types I and III. On the next occasion on which a sample of this serum was put up for agglutination, most reactions took place with Type III coccus emulsion and on the last occasion with Types III and IV emulsions.

On the whole therefore this serum reacted most with Type III coccus emulsion, although the subject had been inoculated with a Type I coccus. For the full readings against all four type emulsions see Appendix II.

Conclusion.

That although meningococci, when tested by Lieutenant-Colonel Gordon's routine method against his four type sera, may show a constant type, yet when inoculated into rabbits or human subjects they sometimes appear to produce more agglutinins for other types than for the type used for inoculation.

APPENDIX I.

Details of the Cases from which the Strains of Meningococci referred to in the Text were isolated.

Thecal Strain "W," Type II (January 2, 1917).—Miss W., aged 35, had been working in a canteen at Sling Camp, Salisbury Plain, in the autumn of 1916. She came home to Oxford "seedy" before Christmas, and was attended by her doctor for about ten days for an attack of influenza. Meningeal symptoms first appeared on January 1, 1917. A lumbar puncture was made on January 2, 1917, when she was extremely drowsy, had signs of meningitis, and blotchy hæmorrhages in the skin. The fluid obtained from the lumbar puncture showed great turbidity with numerous polymorphs and a Gram-negative coccus, and yielded, when inoculated on to rabbit's-blood trypagar, a pure culture of a Gram-negative coccus. From this culture is derived our strain "W" Type II coccus.

The case responded to treatment by intrathecal injections given on four successive days, and after a prolonged illness ultimate recovery took place. Miss W. became stone deaf during the early part of the illness and remained so subsequently, this being the result of an infection of the eighth nerve.

Thecal Strain "G," Type III (February 18, 1917).—Cadet G., aged 16½, fell ill on February 14, 1917, whilst billeted in an Oxford College. He had not been in contact with a known case or been in an infected area. The symptoms were those of meningitis of moderate severity. The case was admitted into the 3rd Southern General Hospital on February 17, 1917. A lumbar puncture was made on February 18, 1917. An opalescent fluid was obtained depositing a small amount of muco-pus. A Claudius slide of this showed Gram-negative cocci and polymorphs. From this fluid inoculated into a Dorset's egg tube, a pure culture of a Gram-negative coccus was recovered. From this culture is derived our strain "C," Type III coccus. Four intrathecal injections were given. The progress was definite but slow, and recovery was ultimately complete.

Thecal Strain "M," Type I (March 1, 1917).—Cadet "M," aged 29, had been at Denham, Bucks, a month before the onset of the disease, which was on February 28, 1917, when billeted in an Oxford College. The symptoms were those of severe meningitis. A lumbar puncture was made on March 1, 1917, the fluid obtained showing numerous polymorphs and a Gram-negative coccus.

On inoculation into a Dorset's egg tube, a Gram-negative coccus was recovered in pure culture. From this our strain "M," Type I coccus is derived.

The illness was severe and the patient died on March 18, 1917. The post-mortem examination showed a healing meningitis of the pia arachnoidea of the brain, with plastic lymph on the spinal cord and infarcts of the heart and both suprarenals.

Thecal Strain "L" (1), Type IV (March 22, 1917).—Private "L." aged 18, stationed in billets at Steventon, Berks, had not been in contact with any known cases of cerebrospinal meningitis or been in an infected area when the disease commenced on March 19, 1917. The symptoms were those of mild but definite meningitis. A lumbar puncture was made on March 22, 1917. The fluid obtained showed polymorphs and Gram-negative cocci, and yielded a Gram-

negative coccus when inoculated into a Dorset's egg tube. From this culture is derived our strain "L" (1), Type IV coccus.

The case reacted well to intrathecal injections, of which eight were given. Convalescence was prolonged, lasting nearly a year, but there were no residual lesions.

Thecal Strain "C," Type IV (?) (April 15, 1917).—Mrs. "C.," aged 49, of Hook Norton, near Banbury, was notified on April 24, 1917, by W. E. Fielden, M.D., as a case of cerebrospinal meningitis. Lumbar puncture had been made on April 15, 1917. From the cerebrospinal fluid inoculated direct into a Dorset's egg tube, a pure culture of a Gram-negative coccus was obtained. From this culture is derived our strain "C," Type IV (?) coccus.

A swab from the nasopharynx, May 23, 1917, proved negative. The case was probably not an endemic one, but infected by another case from Bloxham.

Pharyngeal Strain "L" (2), *Types II and IV, or Type III, May* 10, 1917.—Lieutenant "L" had a chronic naso-pharyngitis, of which a bacteriological diagnosis was asked. His history was that a month ago, while in France, he had been billeted with another officer who had been taken to hospital with meningitis and had subsequently died. From a post-nasal swab taken about May 10, 1917, an impure culture of a Gram-negative coccus was obtained on serum-agar. From this culture, which was purified with some difficulty, our pharyngeal strain "L" (2) coccus is derived.

Thecal Strain "D" Type III), May 17, 1917.—Miss "D.," aged 33, had not been out of Oxford for a year before the illness began. She had collapsed after her work in a restaurant orchestra, and was seen by a doctor two days later, on May 17, 1917, to have mild meningeal symptoms and fever, but no rash. Turbid cerebrospinal fluid showing polymorphs and Gram-negative cocci, was removed by lumbar puncture. From this fluid, inoculated on to Dorset's egg, a Gram-negative coccus was obtained in pure culture, from which our strain "D," Type III, coccus is derived. The disease ran a varying course and the patient died several weeks later from some brain complication, the nature of which was not ascertained by post-mortem examination.

Strain "P" (5), *Type IV*.—This strain was obtained by one of us from the Central Cerebrospinal Fever Laboratory at Millbank on June 30, 1917. It was given us as a Type IV strain, but we have no other information about it.

Thecal Strain "E," Types II and IV (February 4, 1918).—Second A.M. "E." was admitted to Reading War Hospital on February 4, 1918, suffering from acute meningitis, symptoms having first appeared on the previous day. A lumbar puncture was made on the day of admission, and the fluid obtained showed polymorphs and cocci both Gram-positive and Gram-negative. The Gram-negative coccus was isolated at Reading and received by us on February 6, 1918.

APPENDIX II.

Details of Human Experiments.

Experiment 1.—The subject, A. G. G., was inoculated with meningococcus strain "G," Type III, in the following amounts: First day 50 millions, eighth day 50 millions, tenth day 250 millions, twelfth day 1,000 millions, sixteenth day 2,500 millions. With a fresh batch of vaccine on the thirty-seventh day 500 millions, forty-first day 1,000 millions, forty-sixth day 2,000 millions, fiftieth day 10,000

millions, and on the seventieth day 20,000 millions. The serum was tested twice previously to inoculation, and found to contain no agglutinins, and at intervals of four days or thereabouts up to the one-hundred-and-eighth day after the first inoculation. The agglutination results against the four types of meningococci are set out in Table I. The reactions to injection of this subject were almost negligible, slight local reactions being recorded on the sixteenth day (250 millions), thirty-seventh day (500 millions, new emulsion) slight general reactions, aching limbs without fever after the forty-first day (1,000 millions), and the fifty-ninth day (10,000 millions), and a good local reaction on the seventieth day (20,000 millions).

TABLE I.

Showing the agglutination reactions of A. G. G.'s serum with the type coccus emulsions sent out by the Central Cerebrospinal Fluid Laboratory. Fresh batches of emulsion were used for the 76th, the 86th and for the 88th and subsequent days. The controls of these emulsions were uniformly negative, and that of the homologous coccus showed a trace of spontaneous agglutination on the 108th day only, when it was used in slightly less concentration than previously.

Serum of day of experiment	Type I Dilutions of serum 1 in :—				Type II				Type III				Type IV				Homologous coccus			
	20	40	80	100	20	40	80	100	20	40	80	100	20	40	80	100	20	40	80	100
64	—	tr	0	0	—	tr	0	tr	—	tr	tr+	tr+	—	S—	S—	tr+	—	0	0	0
70	—	0	0	0	—	0	tr	tr	—	tr+	tr+	tr	—	T—	tr+	tr	—	—	—	—
76	0	0	—	0	0	0	—	0	0	0	—	0	tr	tr	—	0	—	—	—	—
86	0	0	0	—	0	0	0	—	0	0	0	—	S	S—	tr	—	—	—	—	—
88	—	tr	tr	tr	—	tr	tr	tr	tr+	tr+	tr+	tr	S	S—	S—	tr+	0	0	0	0
93	0	tr	tr	0	0	tr	0	0	tr+	tr	0	0	S—	tr	tr	0	0	tr	0	0
108	0	0	0	0	0	0	tr	0	tr	0	0	0	0	tr	tr	tr	0	S	tr	tr

The abbreviations have the following significance :—

T	Clear fluid and sedimented products.
T—	Large amount of sediment but fluid not clear.
S	Macroscopic granulation visible throughout the entire fluid.
S—	Very fine granulation throughout.
tr+	Granulation and clumps, but not evenly throughout whole fluid.
tr	Any traces of granulation.
0	No reaction.
—	Tube not used.

Experiment 2.—The subject, M. L.-H., was inoculated with an emulsion of strain "M" Type I coccus in the following amounts: First day 50 millions, eighth day 50 millions, tenth day 350 millions, thirteenth day 1,400 millions, sixteenth day 3,500 millions. The serum of the subject was tested against the four types of meningococcus emulsions twice previously to the commencement of the experiment, and found to contain no agglutinins. The serum was tested on the fourth, eighth, thirteenth, sixteenth, seventeenth and thirty-first days, and found to contain no trace of agglutinin against any of the four type emulsions. As this result might have been due to the batch of emulsion used for injection, a fresh batch was prepared, and injections continued as follows: Thirty-seventh day 500 millions, forty-first day 1,000 millions, fifty-ninth day 20,000 millions, seventieth day 30,000 millions. Further estimations of the serum of the subject were made on the forty-first, sixty-third, seventieth, eightieth, eighty-seventh, ninety-third, and one-hundred-and-eighth days, and the results are shown in Table II. The reactions of the subject to these doses of vaccine were both of the local and general type. No reactions occurred after the in-

jections on the first and eighth days, local reactions occurred on the tenth day (350 millions), thirteenth day (1,400 millions), sixteenth day (3,500 millions), when there was considerable inflammatory œdema lasting several days. Slight local reactions occurred on the thirty-seventh and forty-first days. On the fifty-ninth day (20,000 millions) there was a good local and general reaction with fever up to 99° F. and on the seventieth day (30,000 millions) there was a good local reaction, with general malaise, aching limbs and fever up to 101·5° F. in the evening of the same day.

TABLE II.

Showing the agglutination reactions of M. L.-H.'s serum with the Central Cerebrospinal Fluid Laboratory's type coccus emulsions. Fresh batches of emulsions were used for the 80th and for the 87th and subsequent days. The controls of the type emulsions were uniformly negative.

Serum of day of experiment	Type I Dilution of serum 1 in :—				Type II				Type III				Type IV			
	20	40	80	100	20	40	80	100	20	40	80	100	20	40	80	100
70	—	0	0	tr	—	tr	tr	tr	—	tr+	tr	0	—	0	0	0
80	tr	0	—	0	tr	0	—	0	tr	0	—	0	tr	0	—	0
87	—	S—	S—	tr	—	S—	tr+	tr+	—	S	S—	tr+	—	S—	0	0
93	tr+	tr	0	0	tr	tr	0	0	S	S—	S—	tr	S—	tr	0	0
108	tr	tr	0	0	tr	tr	0	tr	tr+	tr+	0	0	tr+	tr+	0	tr

Experiment 3.—The subject, M. E. M., was inoculated with strain "W" Type II meningococcus; on the first day 50 millions, fourth day 250 millions, eighth day 1,000 millions, and with a fresh batch of vaccine on the thirtieth day 500 millions, thirty-fourth day 1,000 millions, thirty-eighth day 1,600 millions, and fifty-second day 5,000 millions. After the inoculation, on the eighth day, there was some slight local irritation, but two days afterwards there occurred a persistent headache, limited to frontal and occipital regions, with pain in the nape of the neck relieved by putting the head back. The subject felt chilly and the headache lasted about five days. Subsequent injections produced only slight reactions, chiefly local, but on the thirty-eighth day some malaise was complained of, and on the fifty-second day slight nasal catarrh. The serum was tested on two occasions previous to the experiment and found to be negative to all four types of meningococcus. It was again tested at intervals of three to four days from the fourth to the seventy-ninth day of the experiment. On none of these occasions did the serum show any demonstrable agglutination against any of the four type emulsions.

Experiment 4.—The subject, A. C., was injected with strain "P" (5) Type IV meningococcus; on the first day 50 millions, fourth day 250 millions, eighth day 1,000 millions, and again with a new batch of emulsion, the thirtieth day 500 millions, thirty-fourth day 1,000 millions, thirty-eighth day 2,000 millions, and fifty-second day 10,000 millions. The serum was tested twice previously to the experiment, and at intervals of three or four days from the first to the seventy-ninth day of the experiment. On no occasion was any demonstrable amount of agglutinin found against any of the four type emulsions. Twice, after the inoculation of the eighth and thirty-eighth day, there was a slight local reaction and on the fifty-second day there was a good local and general reaction with malaise and shivering.

OBSERVATIONS ON A TRANSIENT FORM OF HÆMOGLOBINURIA (BLACKWATER FEVER) OCCURRING AMONGST THE TROOPS IN MACEDONIA.

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Introduction.

Since June, 1916, we have been on the staff of a British General Hospital attached to the Royal Serbian Army, and during that period have had the opportunity of seeing forty-six cases of blackwater fever. Thirteen of these cases occurred amongst the personnel of the hospital and other British units attached to the Serbian Army in the same area. During the same period a neighbouring British General Hospital also treated some thirty cases. Of our cases thirty-eight occurred between October 11, 1917, and March 23, 1918.

The cases varied considerably in severity, some showing transient attacks of hæmoglobinuria only, others presenting marked diminution in the amount of urine or even complete and fatal suppression. In a few instances death was the result of uræmia associated with almost complete suppression of urine (one and a half to two ounces of urine in the twenty-four hours), despite freedom from hæmoglobinuria for two or three days before death. With reference to the amount of urine passed two clearly differentiated types of case were observed: (1) Those associated with polyuria which invariably recovered; (2) those associated with diminution or suppression of the urine, some proving fatal.

The object of this paper however is to draw particular attention to the slighter forms of blackwater fever, namely those showing a transient hæmoglobinuria. We regard the recognition of the danger of these cases as of prime importance for two reasons, firstly, because when hæmoglobinuria has once occurred a recurrence is very probable, and a transient case may suddenly develop a severe or even fatal attack of blackwater fever; secondly, experience leads us to believe that all forms of blackwater fever will be more prevalent in the winter of 1918-19 than they were in the two preceding winters. The grounds on which we base the latter belief will be given later.

Unfortunately, owing to our absence from the British Isles, we have not been able to make any detailed study of the literature of the subject.

Manson[1] appears to recognize the transient cases but does not lay stress upon them. A malarial hæmoglobinuria has been described by some writers and regarded by them as distinct from blackwater fever. Our view, however, is that the transient cases we have seen are true blackwater fever in a mild form, and that except in the degree of severity there is no difference between them and the severe and fatal forms of blackwater fever. All grades between these two extremes have been met with. We are also of the opinion that the disease is not directly due to quinine, and we have seen no cases which could be regarded as quinine hæmoglobinuria.

Symptoms.

In these mild cases the symptoms which have been observed are: Nausea or vomiting, shivering or even a definite rigor, followed by sweating; sometimes pain or a dragging heavy sensation in the loins; usually some degree of jaundice; the passage of port wine or porter-coloured urine which in a few hours becomes normal in appearance.

These symptoms may be slight in degree or moderately severe, but are never as severe as in a sustained case of blackwater fever. They may in fact be no more grave than those accompanying a mild malarial paroxysm, and but for the striking colour of the urine, advice would very likely not be sought in many instances. Indeed it is quite possible that the condition may be overlooked altogether. For instance one patient (No. 0553), who was convalescent from malaria, complained that he had passed blackwater during the night—a true statement—and also said that he had not had a rigor or feeling of cold, or even headache, backache or sickness. Actually his temperature had been 99·2° F., and the night nurse reported that he had shivered and afterwards perspired freely. Such an example, however, shows that the general symptoms may be trivial in nature or even absent.

Actual vomiting, also pain in the back and loins, are not common. The jaundice is variable in degree but never severe, and is of the hæmolytic type. None of these cases has shown more than a moderate grade of fever; the highest temperature recorded was 103·2° F., as a rule when the urine cleared the temperature became afebrile and remained so unless malarial recurrences occurred during convalescence.

The urine at the onset of an attack varies in colour from a reddish madeira to a deep port wine shade, which, in reflected light, appears almost black. After being allowed to stand for a short time, a light brown sediment is deposited, leaving the supernatant urine clear. The amount of deposit is usually considerably less than in the severer forms of blackwater fever. This appearance rapidly passes off and after two or three specimens showing hæmoglobin coloration, the succeeding urine looks normal to the naked eye. Thus Case No. 1618C passed dark "port wine" urine for the first time in the afternoon; the next specimen obtained during the night,

[1] Manson, "Tropical Diseases," sixth edition, p. 286.

although lighter in colour, still contained hæmoglobin; but the third specimen at 9 a.m. on the following morning was free from hæmoglobin. The patient already mentioned (No. 0553) passed three specimens of madeira-coloured urine between 1 a.m. and 8 a.m.; no more urine was passed until 4 p.m. the same day and this contained no hæmoglobin. In our series of cases there has never been any marked diminution in the amount of urine passed; in fact in some cases the converse, a transient polyuria, has been present; thus in the case just quoted fifty-three ounces were passed between 4 p.m. (the first normal specimen) and 8 a.m. the next morning.

Chemical and microscopical examination of the urine also showed a remarkable sequence of changes. The hæmoglobin at first giving a very marked reaction rapidly disappears. The amount of albumin, considerable in the first specimen, rapidly disappears in succeeding ones, but rather less rapidly than the hæmoglobin. Microscopically the first specimen usually shows numerous casts, granular, hyaline and epithelial, also many epithelial cells in addition to a varying amount of granular amorphous debris, and occasionally a few red blood cells. These casts and epithelial cells rapidly disappear from the urine in succeeding specimens, as will be seen by a reference to the accompanying table. This sequence is so striking a feature of the transient form that, in a case admitted to hospital with a history of having passed blackwater, the rapid disappearance of casts and albumin from the urine may be taken as confirmatory evidence of recent hæmoglobinuria. Indeed we are inclined to go further and say that, in this country, this sequence is sufficient to diagnose the occurrence of hæmoglobinuria even in the absence of any history of that symptom.

To explain this series of changes it would seem that the "toxin" of blackwater fever, firstly, by its action on the red blood cells gives rise to hæmolysis with resulting hæmoglobinæmia and hæmoglobinuria, and secondly, by its direct action on the kidney produces necrotic changes in the tubules followed by the throwing off of epithelial casts. In addition to the action of the toxin directly on the renal tissues, renal functions are profoundly influenced by the damaging effect of the passage of hæmoglobin and waste corpuscular débris. Both factors are probably responsible for the marked circulatory obstruction evidenced by the extreme capillary congestion. These tubular and congestive changes are well marked in some of the fatal cases of blackwater fever. The throwing off of the cast is the first step in the process of the repair of the kidney lesion.

In the transient cases we are describing, the "dose" of the toxin is a small one; repair begins at once, for casts are very obvious in the first specimen of blackwater passed. In the severer cases which recover casts are at first seldom seen or are seen only in small numbers; later they increase in number until they reach a maximum, when they may be present in enormous numbers, and then gradually diminish as the case improves,

TABLE SHOWING URINARY FINDINGS IN CASES OF TRANSIENT HÆMOGLOBINURIA.

Case No.	Date	Colour	Sp. gr.	Re-action	Albumin	Guiaic test	Bile pig-ment	Deposit			
								Casts	Cells	R.B.C.	Etc.
16186	4.2.18: 3.30 p.m.	Almost black	1023	Acid	XXX	XXX	..	*Many* granular and a few granular epithelial	Epithelium ..	None ..	..
	Night: 4 to 5.2.18	Red-brown ..	1020	,,	XXX	X	..	*Fewer* in number—same varieties	—	,, ..	..
	5.2.18: 9 a.m. ..	No naked-eye Hb.	1015	,,	X	0	..	*No casts*	Some pus cells ..	Few ..	..
0/553	8.3.18: 1 to 5 a.m.	(Clear) madeira	1030	Acid	XXX	XXX	0	Few granular and fine hyaline	Some renal epithelium and leucocytes	None ..	..
	,, 4 p.m. ..	No naked-eye Hb.	1010	,,	Slight cloud	0	..	None	Few renal epithelial cells and leucocytes	,, ..	..
	4 p.m. to 8 a.m.: 8.3.18 to 9.3.18	Normal ..	1018	,,	,,	0	..	Some granular ..	Renal epithelium	..	..
	14.3.18	,, ..	1030	,,	0	0	..	None	None	None ..	Amorphous urates
0/551	25.2.18: (On admission)	Yellow orange	1020	Acid	XX	0	0	*Abundant* granular, hyaline, epithelial	*Many* renal epithelial cells and leucocytes	Very few	Mucus
	25.2.18	Normal ..	1012	,,	X	0	..	*Some* granular and hyaline; *few* degenerated epithelial	*Scanty* leucocytes and renal epithelium	..	..
	28.2.18	,, ..	1010	,,	V.f.h.	0	..	*Few* hyaline and finely granular	Cluster or two of leucocytes	None ..	Cell debris

Notes on Table.

	Albumin	Guiaic test
XXX	Heavy deposit ..	Very marked reaction
XX	Dense cloud ..	Marked reaction
X	Definite cloud ..	Definite reaction

finally disappearing altogether. It is rare to find casts in cases which pass small amounts of urine and eventually prove fatal. The presence of large numbers of casts is therefore of much importance when considering the question of prognosis in a case of blackwater fever.

The accompanying table sets out the urinary changes in three cases of transient hæmoglobinuria. Cases No. 16186 and 0553 have been referred to above. Case No. 0551, a Greek doctor, was sent in by a French medical officer as a case of blackwater fever. He had passed black water from noon on the previous day until 10 a.m. on the day of admission. No hæmoglobinuria occurred afterwards, but the urinary changes provided confirmatory evidence of his history.

Associated with hæmoglobinuria and the symptoms already mentioned, the spleen is found to enlarge and not infrequently become tender. In some cases the liver also enlarges and there may be tenderness over the gall-bladder region. All these signs disappear shortly after the hæmoglobinuria stops.

Convalescence, if not complicated by malarial relapses, is as a rule rapid and not much more prolonged than after an attack of malaria. A certain degree of anæmia occurs but it is not marked. In most of the cases, however, convalescence was retarded by malarial relapses but without further hæmoglobinuria.

Etiology.

In the course of the present paper we do not wish to enter into a detailed discussion on the etiology of blackwater fever and we shall only deal with certain points which have arisen in connexion with this series of cases. The remarks made apply, however, not only to them but also to blackwater fever in general.

(*a*) *Associated with other Diseases.*—Every case gave a history of repeated attacks of malaria, and many suffered from malarial relapses whilst in hospital. Some were under treatment for, or convalescent from, malaria at the time of the onset of the hæmoglobinuria. No case of blackwater fever has been seen in association with any other disease, with two possible exceptions, which were at the time under treatment for dysentery and malaria. (One of these cases occurred in the present series, viz.: Case No. 16816.) Examination of the blood for malarial parasites was usually negative. Of the nine cases of this variety of blackwater sub-tertian parasites were present in one case only; another case showed scanty parasites of an uncertain type but probably benign tertian. In the remainder no parasites could be found. One of the negative cases however showed hæmozoin pigment in the leucocytes, and benign tertian parasites were found in the blood in a malarial relapse (February, 1918) during convalescence.

(*b*) *Length of time exposed to Malarial Infection before Hæmoglobinuria occurred.*—We are informed that malaria is not a common disease in Serbia

and that it is of a mild type. A large proportion of malaria patients admitted to the hospitals attached to the Royal Serbian Army contracted the disease in the summer of 1916 when the re-equipped Serbian Army, recently landed from Corfu, was encamped in the neighbourhood of Salonica. The army took its place in the line in the early part of August 1916, and at that time there were many cases of malaria. All the transient cases, and all except eight of the more severe forms of hæmoglobinuria, occurred in the winter of 1917-18, and it may be therefore assumed with a considerable degree of certainty that the Serbian cases had not passed through more than two severe malarial seasons. One of the transient cases occurred amongst the British troops attached to the Serbian Army and he came out to Macedonia in June, 1917, and was therefore exposed to one malarial season only.

These two facts, namely, that eight out of the forty-six cases of blackwater fever occurred during the 1917-18 winter, and that no transient cases occurred before this winter, we consider justify our opinion, firstly, that an increase in blackwater fever amongst the troops in Macedonia may be expected in the coming 1918-19 winter; and, secondly, that a definite number of cases of transient hæmoglobinuria, precursors of the more severe attacks, have already very probably escaped, and may in the future escape observation. The increase of liability to blackwater fever associated with, and in all probability favoured by, continuous periods of residence in a malarious and blackwater fever country, has been frequently noticed, and is now well recognized.

(*c*) *Topography, Weather, etc.*—The cases were derived from one sector of the Serbian front which occupies a position in a wide valley leading from the plain up to the mountains where the trenches were situated. In both plain and valley malaria of a severe type is very rife. The incidence of the disease reaches its maximum during the five or six weeks between the middle of September and the end of October. The incident curve of blackwater fever on the other hand did not begin to rise until October, reached its maximum in February, then fell quickly, and after April and throughout the summer kept very low. Most of the cases therefore occurred during the colder part of the year, and there is no doubt that the condition, as in the case of malaria, may be precipitated and aggravated by exposure to cold and fatigue. The influence of these factors is supported by the well-known effect of cold in producing an attack of hæmoglobinuria in cases of paroxysmal hæmoglobinuria. In many instances cold could certainly not be excluded, because falls of snow and hard frosts were frequent in the trenches during these months. In more than one case, however, this factor could apparently be discounted because the attack occurred in quite warm weather, such as was experienced at times during the winter months of 1917-18 and amongst individuals living in the plain and not in the mountains.

(*d*) *Presence of a Specific Hæmolysin, etc.*—A certain number of experiments have been carried out by one of us (L.G.P.) to determine, if possible,

the presence of a specific hæmolysin. The difficulties in demonstrating a specific lysin are great; for it is highly probable that by the time the hæmoglobin appears in the urine the lysin has done its work and disappeared from the blood. This would seem to be so particularly in the transient forms of hæmoglobinuria, and even in those cases which show a naked-eye hæmoglobinæmia at the time of the experiment, the same may be true. Hæmolysis is, of course, taking place coincidently with the rigor, vomiting and raised temperature; and if the serum were taken at this early period better results might be obtained; these symptoms, however, frequently occur before the patient comes into hospital, or are thought to be the onset of an ordinary malarial attack. Up to the present we have not been successful in obtaining blood serum in the initial stage of an attack, and we have not obtained any evidence of a specific lysin.

The sera have been tested against the washed red blood cells of individuals in hospitals for other conditions than blackwater fever, and control experiments have also been done by putting sera of normal individuals up against the washed red blood cells from cases of blackwater fever. As a rule a ten per cent dilution of sera and ten per cent dilution of red cells were used, but in a few cases, in addition to these dilutions, undiluted sera were tried against a ten per cent dilution of red cells. The hæmolytic tubes containing the sera and cells were put into the incubator at 37° C. for one hour, and during that time were shaken about every ten minutes; afterwards they were allowed to stand outside the incubator for twelve hours. As we had no ice-chest this was timed so that the tubes were outside the incubator all night, for the nights were frosty. The sera of blackwater fever patients were also tested against the citrated blood of these normal individuals in order to see if agglutination of the red cells took place. Sufficient serum and cells for these tests can be obtained from one cubic centimetre of blood: this amount of blood can be easily removed from the patient's vein with a hypodermic syringe and needle without doing the least harm to the worst case of blackwater fever.

The sera of five of the transient cases were tested in this manner. In two cases only was there even the slightest degree of hæmolysis, and in each case of these the tinge of hæmolysis occurred with one group of normal cells only. It is, perhaps, noteworthy that these two blackwater sera showed marked agglutination of the red cells when tested against the citrated blood from which this group of cells was obtained.

Marked agglutination occurred in some of the other experiments, but no hæmolysis.

A rather interesting result was obtained in another case. The point has probably been already observed, but it throws a little light on the changes occurring in blackwater fever. The specimen of urine passed by the patient No. 0/553 before the blood was taken contained hæmoglobin; the next specimen, passed some hours later, was free from hæmoglobin, but the blood serum showed most definite tinting with hæmoglobin (hæmo-

globinæmia). The hæmoglobin free in the blood-stream had probably been dealt with by the liver, and it was noted subsequently that the stools apparently contained an excess of bile pigment.

The fragility of the red cells in some of these cases was tested against varying percentages of saline, and found to be normal. It is universally agreed, we believe, that the "fault" in blackwater fever does not lie with the red cells.

(*c*) *Relation between Quinine and Hæmoglobinuria.*—As we have already stated, a lengthy argument under this heading does not come within the scope of this paper. We have, however, formed the opinion that quinine is not *the* cause of hæmoglobinuria. We have seen cases where quinine had not been taken for weeks previous to the appearance of blackwater fever. Patients have been given quinine during the attack, and no untoward results have occurred; moreover, several of the cases have shown typical malarial attacks during convalescence, and have been treated with quinine in doses up to seventy grains *per diem* without a return of blackwater. Outside our own experience, however, there would appear to be some evidence that quinine may in very rare instances act as the determining agent in precipitating an attack of blackwater fever comparable, as already suggested, to the effect of exposure to cold, over-exertion, and fatigue. We are of opinion, however, that the possible existence of such cases should not influence treatment, for, even if they do not exist, they are extremely rare.

We tried the effect of adding red blood cells from cases of blackwater fever to solutions of common salt in strengths of 0·05 per cent to 0·9 per cent in each of which was dissolved quinine bihydrochloride in strengths which we estimated would represent the concentration of quinine in the blood when administered by the intravenous method in doses of ten to fifteen grains. It was found that in some cases hæmolysis did not occur with strengths above 0·3 per cent, i.e., the normal limit; but in other cases hæmolysis occurred in all strengths up to 0·9 per cent. It was, therefore, thought possible to separate out two classes of blackwater fever, namely, those in which quinine could be given, and those in which its action would be harmful; and that in this way the test would prove an important guide to treatment. Later, however, we obtained similar results in patients not suffering from blackwater, and actually taking quinine at the time. It was also found that in cases of hæmoglobinuria, whose red cells showed hæmolysis in all strengths of the solution, the quinine given caused no increase in the amount of hæmoglobinuria, and that after an attack had passed off subsequent administration of the drug did not produce a recurrence.

In concluding our observations on the etiology of hæmoglobinuria, we would add our belief that blackwater fever is due to malaria, although not necessarily associated at the time of its occurrence with a malarial paroxysm, and that the true causal factor of the blackwater fever attack must be looked for in connexion with the toxins of the malarial parasite. Certain work has been done on the malarial toxins, but there still remains

a considerable field for research into their nature. The suggestion that the hæmolysis is due to supersensitization of the red blood-cells does not, in our opinion, give a satisfactory explanation of the fatty degeneration of the myocardium and the necrotic changes found in the liver and spleen in fatal cases. Nor does this theory explain the very marked degenerative and tubal changes, or the extreme congestive disturbances which occur in the kidney in such cases. We consider the uræmia and anuria are due to these renal changes rather than, as is usually held, to the mechanical effect of the blocking of the tubules with hæmoglobin.

Further, these changes much resemble those found in other severe toxic conditions, e.g., eclampsia, and are strong presumptive evidence of the presence of a toxin in the blood. This toxin apparently differs from the ordinary malarial toxin, since in deaths from malaria the spleen, liver, and particularly the kidneys do not show the striking changes seen in blackwater fever. Certain facts appear to point to this special toxin being elaborated in the intervals between malarial attacks, for hæmoglobinuria frequently occurs unaccompanied by any actual malarial paroxysm.

Treatment.

All our patients were treated at the commencement of their illness as if suffering from severe blackwater fever, but, when it was seen that the case was a transient one, treatment was modified accordingly. Warmth, absolute rest in bed, administration of a saline aperient and copious drinks of lemon water, barley water, soda water, etc., were ordered. The only food allowed was milk, and patients were encouraged to take at least five pints of fluids in the twenty hours; some indeed drank as much as eight pints in that period. Some of the cases received rectal salines, five ounces of normal saline being given every two hours or ten ounces every four hours. These were, however, stopped in the course of a few hours when it became obvious that the case was a transient one.

At the end of forty-eight hours the strict milk dietary was relaxed and milk pudding, bread and milk, jelly, etc., were allowed. The diet was further increased *pari passu* with the improvement in the urinary symptoms, which usually cleared up so rapidly that the patient soon reached a full diet.

Quinine was given, not as a routine measure, but only if evidence of active malarial infection was shown, either by finding parasites in the blood or by the development of malarial symptoms following on, or in addition to, the hæmoglobinuria. When quinine is necessary it is perhaps best administered intramuscularly, but it has also been given either by the mouth or occasionally by the rectum, five grains being added to each rectal saline. Quinine sulphate has been given by the mouth and the bihydrochloride by the two other methods.

Quinine amblyopia is stated to be more common in blackwater fever than in malaria, and therefore it has been recommended that great care be taken in determining the dosage of quinine in this disease; whilst not disputing this point we think that some of the visual symptoms may have been due to retinal hæmorrhages, such as have been observed in certain of our cases by our colleague, Capt. W. Niccol, R.A.M.C., Ophthalmic Surgeon Specialist to the hospital. During the hæmoglobinuria we have not given more than forty-five grains in the twenty-four hours, but in the relapses of convalescence we have given sixty grains daily, and in one case of a severe relapse seventy grains a day were given on two successive days.

During convalescence a generous diet was ordered and iron and arsenic given. The period of convalescent treatment was continued for a longer period than for an ordinary malarial attack. The period of absolute rest in bed should be about ten days; some of our cases however were up before that length of time had expired, because it is almost impossible to keep a Serb patient in bed when he is feeling anything approaching well.

As previously stated, malarial relapses occurred during convalescence in nearly all the cases and were treated as ordinary malarial attacks.

A careful watch should be kept on the urine during these relapses on account of the possible recurrence of hæmoglobinuria. All cases after recovery from an attack should be removed from a blackwater fever area, and if possible evacuated from Macedonia owing to the risk of recurring and more severe attacks of blackwater fever.

Prognosis.

The prognosis of the actual attack of transient hæmoglobinuria is invariably good; indeed, as stated above, the symptoms may be quite trivial, and most cases would recover even if no treatment were received. The outlook however may be grave in a patient already seriously debilitated by previous malaria or dysentery. In the only case in our series which gave us any anxiety, there was marked debility from recent malaria and dysentery at the time the hæmoglobinuria occurred; after three days, however, the patient made a rapid improvement and was soon out of danger.

As for their future prognosis, we believe that those cases are liable to recurrences of hæmoglobinuria, especially if they remain exposed to malarial infection. Moreover, in all probability these recurrences will prove more severe than the original attack. Judging from the cases we have seen, no permanent damage is done to the kidneys by these transient attacks.

Conclusions.

This paper has been written to draw particular attention to these cases of transient hæmoglobinuria for the following reasons:—

(1) The condition is frequently a slight one and may escape notice

unless looked for; but apart from its mild character it is in all respects the same disease as blackwater fever and should be so regarded. All varieties, including intermediate cases between the transient and the severe and fatal forms of blackwater fever, have been seen.

(2) Transient hæmoglobinuria is very likely to be the precursor of more severe recurrences.

(3) It is highly probable that the transient cases and all other forms of blackwater fever will be more common among the troops in Macedonia during the winter months of 1918-19 than in previous winters.

Finally, our thanks are due to Colonel S. F. Clark, A.M.S., the officer commanding the hospital, for allowing us to make use of these cases; also to our colleagues—Captain H. C. Nickson and C. G. Teall in particular—for their help in the diagnosis and treatment.

Macedonia, 1918.

Clinical and other Notes.

NOTES ON THE TREATMENT OF WOUNDS INFECTED WITH *BACILLUS PYOCYANEUS.*

By Major PHILIP TURNER
AND
Captain G. RICHARDSON.
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Infection of wounds by the *Bacillus pyocyaneus* is comparatively common. Sometimes the patients arrive with the wounds already infected; on the other hand, the infection often develops some time after admission. Infection may be from some previously infected wound, or it may arise from the use of infected instruments or apparatus, especially arm baths. There is also reason to suspect that some wounds are already infected with this bacillus, but owing to the presence of other organisms its growth is impeded and the characteristic appearances of the pus are not present until the local conditions of the wound become favourable for its free growth. The virulence of the organism appears to vary considerably.

Characters of an Infected Wound.

(1) The suppuration is profuse, and it has a characteristic bluish-green colour, which varies considerably in shade, and which stains the dressings and also very often the patient's skin.

(2) There is a characteristic, offensive musty odour.

(3) When this infection appears it tends to extend to other wounds in the same ward, although careful precautions are taken.

(4) When it has once appeared in a wound it is very difficult to eradicate, and the healing of the wound is often greatly impeded.

In addition the following may also be mentioned.

(5) There may be an intractable diarrhœa due to infection of the intestinal tract, presumably of septicæmic origin, and in one case recently *B. pyocyaneus* has been isolated from the blood.

(6) As the result of the prolonged suppuration there may be considerable weakness and anæmia.

Owing to the above facts wounds infected with this organism have been, in some hospitals, isolated and treated in separate wards. The infection is not dangerous to life and, as a rule, eventually the cases do well. Indeed, it would appear in most cases that the wound must be granulating and showing signs of repair before the organism can grow sufficiently freely to produce the characteristic pus. Many cases in which routine bacteriological examination of pus shows *B. pyocyaneus* without clinical signs of infection, have later, quite suddenly discharged pus of characteristic colour and odour. Hence the infection frequently appears in wounds that are regarded as doing well, but in which the local condition is favourable for the growth of the *B. pyocyaneus*.

TREATMENT OF WOUNDS INFECTED BY *Bacillus pyocyaneus*.

In the autumn of 1915, "blue pus" cases were isolated at this hospital, and in September there were between thirty and forty cases. Eusol had just been generally adopted as an antiseptic, and its systematic use in the form of baths, soaks, and for syringing was employed for these patients. The results were disappointing, and eusol appeared to have no more effect than hypertonic saline, carbolic, and other lotions previously employed.

In June, 1916, I was led to try hot eusol fomentations owing to some successful cases in which a very foul odour had been overcome in this way. The first case on which this treatment was employed was a case of gunshot-wound thigh, compound fracture of femur. This man, wounded June 5, admitted June 9, was doing very well, when on June 18 marked and characteristic signs of *B. pyocyaneus* infection appeared. With four-hourly eusol fomentations the colour and odour had completely gone in twenty-four hours, and the suppuration was very much less profuse. Eusol soaks were then substituted, with the result that on June 26 a faint coloration again appeared. Twenty-four hours' treatment with hot eusol fomentations caused this to disappear, and it never recurred.

No cultivation was taken before the eusol fomentations were started, but several were taken afterwards, and no *B. pyocyaneus* was ever found.

The second case was a patient admitted on June 3 to the same ward with a perforating wound of the right shoulder, fracturing the acromion and head of the humerus and opening the shoulder-joint. He also was doing very well, when on June 17 (suggesting infection from the preceding case) a marked and characteristic colour and odour of the pus suddenly appeared and a bacteriological examination showed a profuse growth of the bacillus. Here also with eusol fomentations the colour and odour completely disappeared in twenty-four hours, and the discharge was much less profuse, but in spite of the absence of clinical signs cultivations still showed a slight growth of the bacillus. The fomentations were continued for a week when a return to eusol soaks led to a reappearance of the characteristic signs, so fomentations were resumed with immediate disappearance of colour. The pus remained of a creamy colour until the man left hospital, but the organism, as shown by bacteriological investigation, was not completely eradicated.

Since the above two cases every case of a wound infected by *B. pyocyaneus* has been promptly treated in this way without isolation. There were not altogether more than about twenty-five cases in the succeeding five months, and never more than two cases at the same time in any ward until recently, when in a small ward containing five wounded German prisoners four cases appeared practically simultaneously. Of these, when treated with eusol fomentations, two rapidly cleared up, one cleared up but slightly, recurred on omitting the fomentations, while the fourth, a deep penetrating wound of the knee-joint, though very much improved, still showed pus tinged with a slight blue-green colour.

The two cases first mentioned in some detail were both in a ward containing forty-two beds, at the time all occupied with wounded men, and no further cases appeared while they were in hospital. Hence it would seem that when the infection is promptly recognized and treated in this way the tendency to spread is very much diminished.

The results of the treatment of these cases by hot eusol fomentations may be summed up as follows:—

(1) In many cases, especially in superficial wounds and where drainage is free, all clinical signs of infection by the *B. pyocyaneus* disappear within twenty-four hours, or even less.

(2) In a considerable number of cases a faint coloration of the pus persists for some time, often to such a slight extent that if the wound was not known to have been infected the presence of the organism would not be suspected.

(3) In either of the above groups, if the colour should reappear after the fomentations have been omitted, they should be at once recommenced. In any case the fomentations should be continued for some days after all characteristic signs of *B. pyocyaneus* infection have disappeared.

(4) Complete disappearance of the clinical signs and eradication of the bacillus is more likely in superficial and widely open wounds. A faint coloration of the pus is more likely to persist in deep and sinus-like wounds, such as compound fractures; in these, complete eradication of the bacillus will be more difficult or impossible.

(5) It would certainly appear that the tendency of the infection to spread is very much diminished. This is the case even when a slight tinge of colour persists, or when cultivation still shows the presence of the organism.

(6) It is quite safe to treat these cases in an ordinary ward with other infected wounds, provided that ordinary precautions, such as dressing these cases after other cases, are taken.

The question now arises as to whether the action of hot eusol is merely a bleaching action simply decolorizing the pus, or whether it really has any action in hindering the growth of, or actually destroying, the organism. That it has a bleaching action on the colour is certain, and is easily proved. It is only necessary to take a cultivation in the laboratory, and add a small quantity of eusol which has been heated nearly to boiling point. In a few seconds the colour, except in the deeper parts of the medium to which the eusol takes time to penetrate, completely disappears. Cold eusol does not have this effect. That it has some effect in destroying and in diminishing its growth and virulence appears certain from the clinical facts noted above.

The results of a large number of bacteriological investigations may be summed up as follows:—

(1) In some cases the pus may have a bluish-green colour and an offensive odour, and yet no *B. pyocyaneus* can be found even after repeated cultivations. In these cases diphtheroid organisms are found, and it is possible that these are responsible for the colour and odour of the pus. On the other hand, it is very likely that the *B. pyocyaneus* is present, but that its cultivation and recognition are prevented by the other organisms present. These cases clear up rapidly when treated with hot eusol fomentations.

(2) In many cases the *B. pyocyaneus* has been found on bacteriological examination of a wound which shows no clinical signs whatever of the infection, and in which its presence was unsuspected. On one occasion the pus from a wound of the foot had a bright orange colour; a cultivation was taken to ascertain the nature of the infection, and the result showed a profuse growth of *B. pyocyaneus*. This supports the view that many wounds may be infected, but that a

certain stage of healing or other local condition may be necessary for the profuse growth of the organism and the production of the ordinary clinical signs.

(3) If cultivations are taken from infected wounds while the treatment of hot eusol fomentations is in progress, there is an evidence of decreased virulence, as shown by slower growth and by diminished and slower production of colour.

(4) In some cases if cultivations are taken every two days, the organism may entirely disappear. This is more likely to be the case in shallow and superficial wounds, and may occur in two or three days, or after a slightly longer interval. In deep and sinus-like wounds a faint growth may persist for a very long time, and is usually associated with a faint greenish tinge in the pus. It may also persist in the entire absence of all clinical signs.

(5) Complete eradication from deep wounds is difficult. A cultivation may be negative, and even though the treatment is continued, and clinical signs are absent, a later cultivation may give a positive result.

(6) Clinical and bacteriological evidence combined show that virulence of the organism varies considerably, and that a cultivation may show its presence in the absence of clinical signs. Under these circumstances it is practically non-infective, and does not harm other patients or the wound. It is when the clinical signs are present that the pus is infective, and the organism is likely to spread to other patients, and seriously to retard the process of healing.

There is no doubt that the treatment with hot eusol fomentations of wounds infected by *B. pyocyaneus* has a marked effect on the virulence of the organism in question. One point which has been noticed is the difficulty experienced in obtaining any pigmentation of the medium in a culture derived from a discharge of a wound which is receiving hot eusol treatment. Numerous subcultivations are necessary to restore the colour-forming properties of the organism, and one is not always successful in bringing back this characteristic feature of *B. pyocyaneus*.

Another point is that the actual growth of the organism itself is not so profuse after hot eusol treatment as it is after treatment with saline or other dressings, and also that after the former treatment one has sometimes noticed a certain tendency of the organism to die out on cultivation.

The following is the method employed in treating these cases:—

(1) As soon as a wound is suspected to be infected, a specimen of the pus is sent to the pathological laboratory for examination. If the clinical signs are definite, treatment by hot eusol fomentations is commenced at once. In a doubtful case the result of the examination may be awaited before this.

(2) The fomentations must be of sufficient thickness and size; they must be as hot as the patient can stand, and must be changed four-hourly. A five per cent solution of eusol heated to boiling point is employed. The wringer should be of canvas or strong calico, since ordinary wringers of linen or flannel are rapidly destroyed.

(3) When the wound is deep or sinus-like, or when a slight coloration persists, the wound may be syringed twice daily with eusol as hot as the patient can bear, or packs of Eupad powder wrapped in gauze and moistened with hot eusol, may be employed in addition to the fomentations; this is often very effective.

(4) Frequently the odour and colour will completely disappear in twenty-four hours or less, but the fomentations should always be continued for at least three or four days after the disappearance of the clinical signs.

(5) When the fomentations are omitted, eusol or saline soaks may be used, but if there is a return of colour and odour, treatment by fomentations must be resumed.

(6) A bacteriological examination of the pus should be made every two or three days as a guide to treatment. Cases in which the clinical signs of the infection are absent but the organism is found on bacteriological examination are probably harmless; but it is wise in these cases to continue the eusol fomentations for a long period.

PYODERMIA OF PARASITIC ORIGIN.[1]

By Captains H. C. SEMON and H. W. BARBER.

Royal Army Medical Corps.

It is impossible to work for any length of time at a military hospital for diseases of the skin without being impressed by the large preponderance of cases of pyogenic infection. Thus, out of a total number of 669 patients admitted under our personal care between April 1 and May 9, 1917, 631, i.e., 94·3 per cent. were cases of this nature.

Among soldiers, pyodermia of the scalp, face and neck, is usually associated with the seborrhœic diathesis (Darier's "kerose"), whereas, when it occurs on the trunk and limbs it is, in our opinion, almost invariably the result of a concomitant or preceding parasitic infection, viz., scabies or pediculosis.

It is the object of this paper to establish the parasitic etiology of pyodermia of the trunk and limbs, to emphasize the striking differences in the clinical pictures produced by the acarus and the louse, and to describe briefly the therapeutic measures which, in our hands, have yielded the best results.

There is seldom any difficulty in recognizing pyodermia due to scabies, even though there be no active lesions present. The distribution of the eruption, or of what remains of it when the case comes under observation, is highly characteristic.

As it is of paramount importance in the differential diagnosis of the various types of pyodermia, we may be pardoned for briefly recalling the main features of the scabietic eruption. For descriptive purposes we propose to consider:—

(1) A case of early scabies.

(2) One in which secondary pyogenic infection has occurred.

(3) One in which the affection manifests itself in a subject with the eborrhœic diathesis.

(1) To meet with cases of early and uncomplicated scabies in troops fresh from the trenches is exceptional, as pyogenic infection is a rapid and almost constant sequel. In such, burrows and vesicles, if present, can most easily be demonstrated on the hands, especially along their ulnar borders, and between the fingers, on the flexor aspect of the wrists, on the prepuce and glans penis, and on the ankles and dorsum of the foot.

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[1] For the purpose of this article it is proposed to use the word "pyodermia" to include the various types of lesions denoted by the terms impetigo, furunculosis and ecthyma.

(2) When secondary infection has occurred, papules and superficial pustules and boils make their appearance, not only in the above situations, but also on the extensor surfaces of the elbows, the anterior axillary folds (where they are sometimes associated with burrows), round the nipples, and very commonly around the umbilicus, and on the lower half of the buttocks. On the lower extremities the eruption is most evident on the posterior and internal aspects of the thighs, the anterior aspect of the knees, the popliteal space, and behind the malleoli. It is also worthy of remark that long after all evidence of active infection has subsided, chronic pruriginous papules tend to persist in certain situations, particularly the wrists, the inner surfaces of the thighs, the buttocks, and on the scrotum and penis. A feature of the scabietic eruption that has helped us in doubtful cases of pruritis and pyodermia—and one the importance of which we particularly desire to emphasize—is the peculiar goose-like appearance of the affected cutis in general. On examination with a lens this appearance is found to be due to the erection of the pilo-sebaceous follicles, and in our experience it is an almost constant, though unexplained phenomenon in scabies.

(3) Where the exudative seborrhœic diathesis exists, infection with scabies is usually associated with a severe and widespread eruption. The acarus is one of the most potent agents in provoking and lighting up an acute seborrhœic dermatitis in persons thus predisposed, which is not infrequently mistaken for the dermatitis excited by the injudicious use of sulphur.

(N.B.—On the other hand, seborrhœic subjects are particularly liable to suffer from sulphur dermatitis.)

The eruption begins as a discrete papule, follicular eczema confined to the erected pilo-sebaceous follicles already described. Later, confluence takes place by the eczematization of the intervening skin, and this discrete follicular appearance is lost, and diffuse patches of eczema, which may later coalesce to form large plaques, make their appearance.

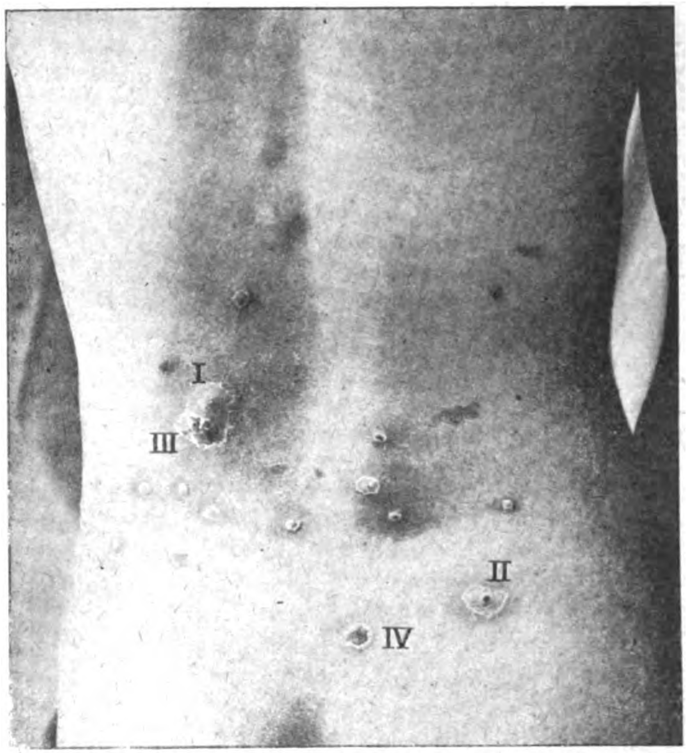
These characteristic lesions may be generalized, but tend to be most severe and persistent on the forearms, the inner surface of the upper arms and axillæ, between the scàpulæ, on the lower abdomen, on the inner surface of the thighs, and in the popliteal spaces. In this type of case seborrhœic eczema of the face and scalp often co-exists, and is apt to prove a trap to those who have hitherto believed that facial eruptions preclude a diagnosis of scabies.

Pediculosis.

The conditions under which our troops have been fighting are responsible for the occurrence of cases of pediculosis far more severe and extensive than are commonly seen in civil hospital practice. There is no doubt whatever that in this connexion the *Pediculus vestimentorum* or *corporis* is the chief offender. It is rare to find *P. pubis*, while *P. capitis* is still more uncommon. We will, therefore, confine our remarks to the *P. vestimentorum*. The following description of the main external characteristics of the parasite is taken with acknowledgments from that excellent monograph, "The Louse problem at the Western Front," by Lance-Serjt. A. D. Peacock, R.A.M.C., T.F., M.Sc. (Dunelm).

The female is about four millimetres in length, the male about three millimetres. The head bears one pair of antennæ, and the black eyes. The three thoracic segments are fused and present but little demarcation. There are three

pairs of strong legs attached to the thorax, each of which terminates in a short powerful spine. There are eight abdominal segments, the two terminal being fused. Posteriorly, the male is pointed and the penis may sometimes be seen extruded, whereas, in the female, the posterior end is bilobed, and bears a pair of ventral copulatory organs. It is well known that the female deposits her eggs in clothing of all sorts and in blankets, and most of the prophylactic measures against "lousiness" have been directed to the sterilization of the soldiers' kits.

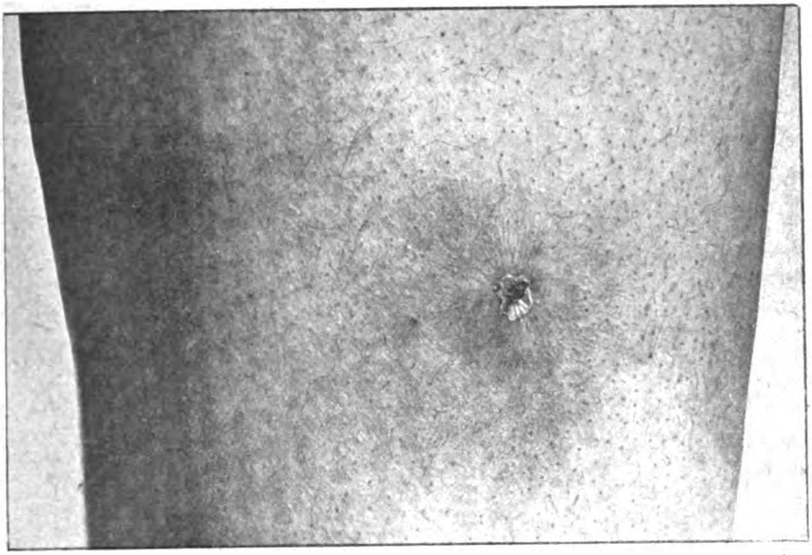


A

An absolutely characteristic picture of pediculosis. Note the localization and the appearance of the lesions. I. An early pustule, i.e., infected bite, with its central yellow vesicle. II. The central vesicle has become a small crust covering a small underlying ulcer. III. Infection is spreading peripherally along the lymphatics and the circular ulcer is thus being produced. IV. The circular encrusted ulcer.

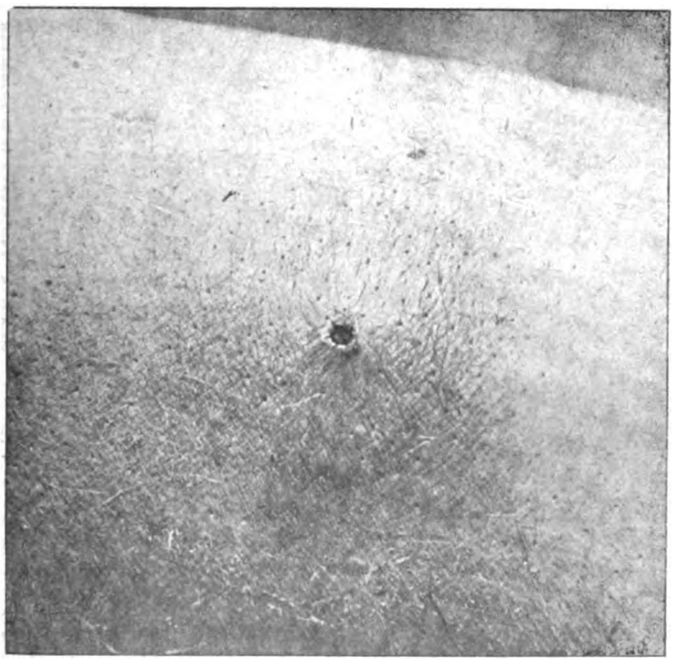
It does not appear, however, to have been generally realized that the *P. vestimentorum*, like the *P. pubis*, also almost invariably attaches its eggs to the pubic and perineal hairs, and less commonly to those of the axillæ, and other covered hairy regions. In no available text-books or monographs to which we have had access is this fact referred to, although its importance is at once obvious and far reaching.

Some months ago, one of us (H.S.), in examining seven consecutive cases of ecthyma and furunculosis of the lower extremities, happened to notice in each of



B

The pediculous boil in an early stage. Note (1) The central small dark crust capping the elevated, dusky, cone-shaped and puckered focus of infection; (2) external to it a fine collarette of white scales; and (3) a surrounding halo of hyperæmia.



C

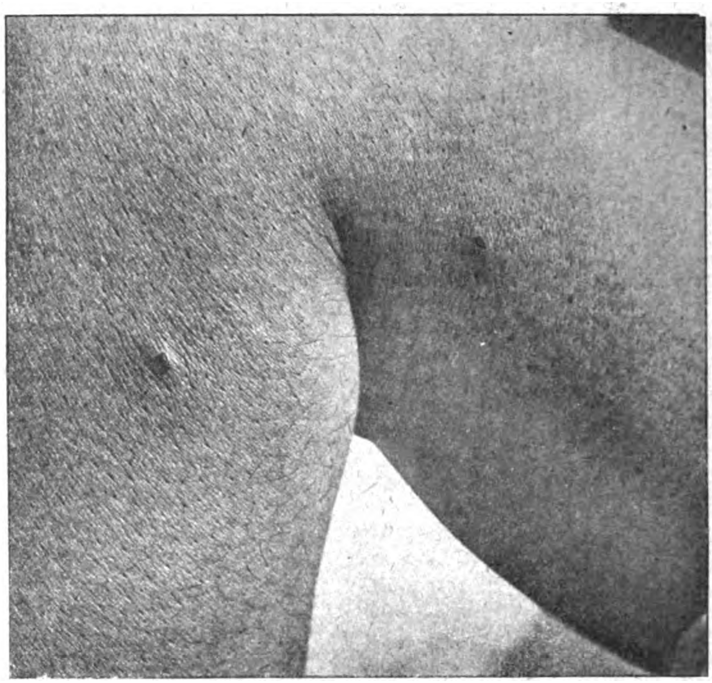
Pediculous boil on the anterior surface of the thigh. A crateriform ulcer is in progress of being formed. The characteristic circular crusted lesion would ultimately result.

them the presence of "nits" on the pubic hairs, and from this time forward we have made a point of carefully examining the pubic and axillary hairs in every patient that has come before us.

The results of our observations may be summarized as follows:—

(1) In almost every case presenting any or all of the lesions we have learnt to associate with pediculosis, "nits" were found either in the pubic, axillary or perineal hair.

(2) In cases of pediculosis in which new lesions developed while the patients were actually under treatment in hospital, careful search of the above-mentioned hairy regions almost invariably revealed the presence of "nits" which had



D

Two early boils which our experience has taught us to recognize as of pediculous origin. They were situated on the fore and upper arm of a patient with marked evidence of "lousiness" on the rest of his body.

escaped the attention of the orderly in charge of the case. Removal of these, the application of paraffin or 1/40 carbolic lotion, and a complete change of kit were always successful in preventing the further appearance of fresh pustules. It may here be said that until we realized the importance of the pubic and axillary hair as breeding places for lice, our cases of pediculosis were constantly developing new furuncles (i.e., infected bites); now that we insist on the pubic and axillary hair being cropped and all nits removed with paraffin, this no longer occurs. The cases are consequently cured in a very much shorter time.

(3) Although *P. pubis* is occasionally met with, and when present is usually found both on the pubis and in the axillæ, in the vast majority of our cases the eggs found in these regions were those of the *P. vestimentorum.* We were first led to this conclusion owing to the frequency with which live specimens of *P. vestimentorum* were found crawling among the egg-laden hairs, particularly on the pubis, although *P. pubis* were absent. *We have since succeeded in hatching out young P. vestimentorum from hairs removed from the pubis, and kept*

E

The pediculous lesions are here displayed in several stages. Above the right iliac crest (and somewhat out of focus), is a late stage of the superficial circular ulcer (4) in text. On the right buttock and in close proximity to the centre of the natal cleft is an abortive example of the type described under (5) in text. The remainder partake of the characters described in detail under the heading of superficial pustules and boils.

at body temperature for several days. This experiment conclusively proves that the *P. vestimentorum* habitually lays its eggs on human hair, and this fact should always be carefully considered in undertaking prophylactic measures against louse infection.

We may now consider the different lesions met with in association with pediculosis. Of these there are three main types:—

(1) The actual bite of the parasite.

(2) Superficial uninfected scratch marks.

(3) Superficial pustules and boils.

(4) Circular encrusted lesions of varying depth.

(5) Very characteristic linear lesions, presumably a sequel to (2) and (4).

(2) Scratch Marks.

These are most commonly situated on the shoulders, chest, buttocks and sacral region, upper parts of thighs, both internal, anterior, and external surfaces, and on the legs. The excoriations correspond in their different situations to the lines along which the patient can most easily scratch himself ("grattage instinctif"—Dubreuilh). Thus on the buttocks they tend to radiate upwards and outwards from the anus. On the outer surfaces of the thighs they run vertically upwards, on the inner surfaces upwards and outwards and similarly on the sacrum.

At this stage it is interesting to compare the scratch marks of scabies with those caused by the pediculus. We have already referred to the erection of the pilo-sebaceous follicles in scabies, and in this disease the scratch marks appear as minute pinpoint blood crusts at the apices of the erected follicles, whereas, in pediculosis, in which no such follicular erection is seen, the scratch marks are merely linear excoriations of the otherwise normal epidermis.

(3) Pustules (Superficial): Boils (Deep).

Apart from (1) and (2) our observations would lead us to believe that a superficial or deep pustule is the initiatory stage of the other lesions met with in pediculosis. The sequence of events is as follows:—

(*a*) An indurated irritable bright red halo arises around the original bite. In the centre of this a minute yellowish-white vesicle rapidly drying to form a crust, makes its appearance. When pressure is applied to a superficial lesion at this stage a small quantity of pus is exuded from the central vesicle or crust. In the deep variety (or "boil") which is often elevated and surrounded by a wide area of induration, similar treatment results in the forcible projection of a considerable quantity of sanguineous pus, from what is evidently a bottle-shaped cavity. In both types of lesion the superficial opening or mouth is very minute and of definitely circular outline, a fact that supports our view that these pustules are originally formed round punctures made by the parasite. If these pustules are dealt with in this early stage by ordinary antiseptic applications (e.g., tinct. iod.) they usually involute without progressing further, but if not interfered with, the lesions tabulated under (4) are apt to result.

(4) Circular Encrusted Lesions of Varying Depth.

It is not difficult to trace the progressive development of ulcers of varying depth and extent (as may be seen by a reference to the accompanying photographs), from the pustules above described.

(5) Linear Impetigo.

Superficial linear encrusted lesions result from the exudation of serum along the lines of excoriation due to scratching; they may occur in any pruriginous complaint, and are in no way especially characteristic of pediculosis.[1] On the

[1] Major MacCormac and Captain Small have recently drawn attention to the fact that superficial "linear impetigo" may be a manifestation of what they aptly term a "war neurosis." It is frequently associated with anæsthesia of the palate, altered cutaneous sensibility, and other stigmata of the psychopathic state.

other hand, the variety which is pathognomonic of louse infection is a gutter-shaped ulcer covered by a brownish crust, and of considerable depth. Its outline varies with the stage of its development, which, in our opinion, proceeds from the longitudinal digital excavation of one of the circular ulcers above described; and in fact in a severe case of pediculosis all the intermediate stages between the

F

This photograph of the loins demonstrates a case of "linear impetigo," a very favourite feeding ground of the pediculus: lesions in this region when of a pyodermic character are almost invariably the result of louse infection.

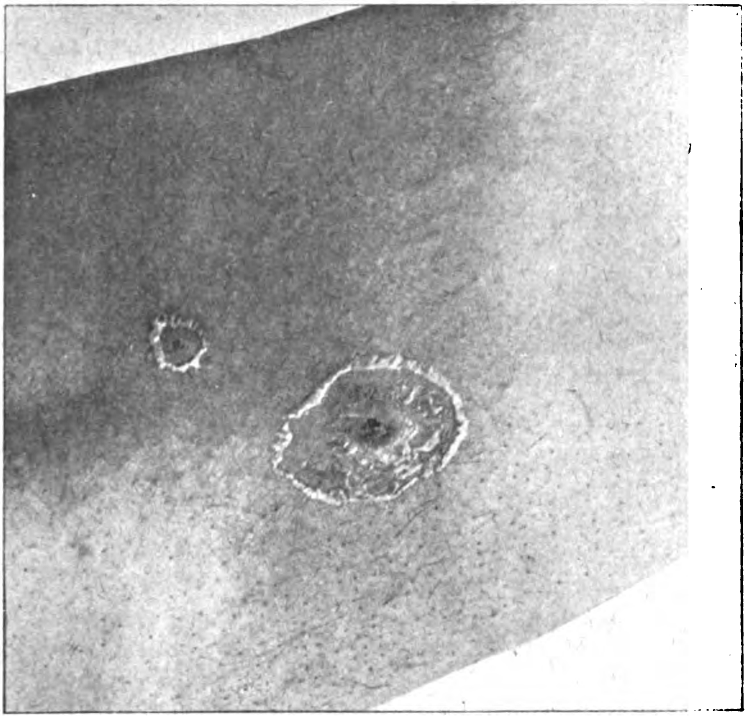
circular and the rectangular gutter-shaped ulcer so called "impetigo linearis" can easily be demonstrated (*vide* photographs). These circular and linear lesions when healed are invariably replaced by bluish stains and brown pigmentation which persist a long time, or if sufficiently deep, by the formation of actual scar tissue. The chief points in the differential diagnosis of the eruptions due to scabies and pediculosis may now be presented in a tabular form.

SCABIES.	PEDICULOSIS.
Localization.	
Hands, wrists, elbows, anterior axillary folds, umbilicus and abdomen, lower triangular area on the buttocks. Penis and scrotum. Front of knees, ankles and feet.	Posterior axillary folds, shoulders, sacral region and upper part of the buttocks, groins, thighs, and the skin between knees and ankles.
Type of Lesion.	
Burrows, vesicles, small superficial crusts, papules, pustules and a specific erection of the pilo-sebaceous follicles with secondary eczematization, especially in seborrhœic cases. Scratch marks are represented by minute blood crusts at the apices of the erected follicles.	Superficial and deep pustules, with a surrounding red and indurated halo. Circular encrusted ulcers of varying depth and size, but on the whole very much larger than those met in scabies. "Linear impetigo."

It is obvious that since infection with both the parasites is quite common, the two clinical pictures may be superimposed.

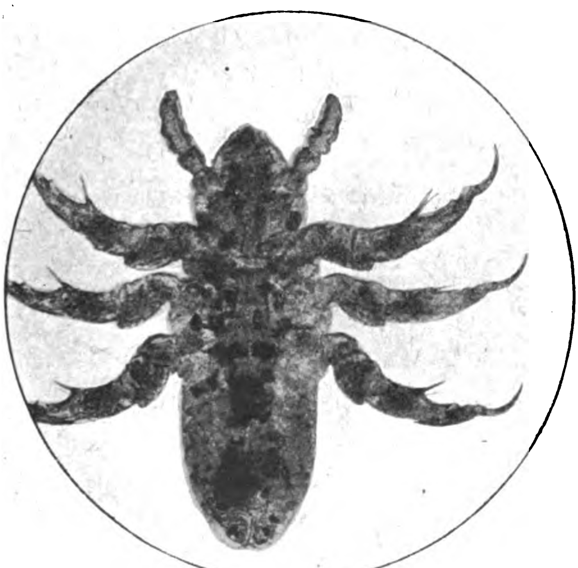
G

A pediculous boil from which the crust has been removed and the pus expressed. It demonstrates very clearly the commencement of an ulcer which later assumes an ecthymatous type.



H

The well-defined "collarette" will be noted in both the above lesions. It would seem to be a common feature in boils due to lice.



I

Microphotograph of young *Pediculus vestimentorum*, artificially hatched from ovum on a pubic hair.

PROPHYLAXIS OF PEDICULOSIS.

It is beyond the scope of this paper to supplement by other suggestions the measures for the disinfection of blankets and clothing at present in use at all general hospitals and military cleansing depots in France. We would, however, emphasize the extreme importance of simultaneously eradicating the reservoirs and breeding places on the human body itself (as is done in scabies), for which purpose baths, medicated or otherwise, are not sufficient. If these are overlooked, it is obvious that there is every likelihood of a rapid re-infection of the sterilized garments within a short time of their re-issue. We have found the cropping of the pubic hair and the repeated application of paraffin, or 1/40 carbolic lotion to the pubis, perineum, and axillæ quite effective—although there is no doubt that if it could be supplied, petrol (which is used for this purpose in the French Army) would be the most powerful agent, as it not only kills the adult parasite instantly, but also penetrates the chitinous envelope of the ovum, and detaches it from the hair.

An improvement of petrol is the solution of naphthalene one per cent, and sulphur one per cent in benzol or petrol, recommended as of proved efficiency by Captain J. A. Gunn, R.A.M.C. (T.), M.D., D.Sc., in the *British Medical Journal*, May 5, 1917.

This solution is not only prophylactic to garments, momentarily steeped in it, over several months, but is, as we are informed, and have ourselves proved, instantaneously lethal to both parasites and their eggs.

Treatment.—In soldiers the routine treatment of scabies has already been exhaustively dealt with in the current number of *The British Journal of Dermatology* by Major H. MacCormac, R.A.M.C. (T.), M.D., F.R.C.P.; it is, therefore, unnecessary to discuss it here.

The most important point to be observed in the treatment of pediculosis is the discovery and elimination of the parasite and its eggs.

The methods found efficient by us have already been described. It now remains to mention briefly our methods of treating the secondary lesions.

(1) *Treatment of the Primary Pustule.*—If of small or moderate size, expression of the contained pus, and painting the surrounding skin with iodine, is almost always sufficient to ensure resolution.

(2) When ulceration and crusting have occurred, there is nothing which in our hands has yielded better results than an ointment of the following composition:—

Acid. salicyl. } Sulph. precip. }	āā gr. x
Ung. hyd. ox. flav...	ad ℥i

This is kept applied day and night on linen or lint, and in from four days to a week the superficial ulcers will be found in the majority of cases to have healed completely. Deep ulcers of an ecthymatous type also do well under it, especially if the patient is kept in bed with his legs raised. It is only occasionally that we meet with the deeply eroded indolent variety. These have to be treated on general principles with the patient in bed, and will tax the therapeutic resources and skill of the physician to the utmost.

The views which we hold on the great importance of the pediculus as a cause of disability are strongly supported by the figures we submit below.

The results of our analysis may be tabulated as follows:—

TOTAL NUMBER OF CASES ADMITTED BETWEEN APRIL 1 AND MAY 9, 1917, 669.

669

- Pyodermias 631
  - Scabies 171
  - Pediculosis
    - (a) In which lice or ova were present on pubic or axillary hairs 190
    - (b) In which no lice or ova were found, but in which there was presumptive evidence of pediculosis, e.g., melanodermia, scratch marks on shoulders, etc. 67
  - Scabies and pediculosis co-existing 24
  - Seborrhœa 112
  - Other cases 67
- Other diseases, e.g., psoriasis, herpes, eczema, tinea, &c. 38

These are the combined results of our independent observations; the individual figures were as follows:—

	Scabies		Pediculosis (a)	Pediculosis (b)		Scabies and pediculosis		Seborrhœa		Other cases of pyodermia		Other cases		Total
H. C. S. ..	101	..	83	44	..	11	..	51	..	42	..	14	..	346
H. W. B. ..	70	..	107	23	..	13	..	61	..	25	..	24	..	323

Thus the various totals correspond fairly closely under each heading.

It will be seen that out of a total number of 631 cases of pyodermia, 452 were associated with parasitic infection, i.e., 71·6 per cent. Of these latter, 171, i.e., 37·6 per cent, were consequent on scabies alone; 257, i.e., 56·9 per cent, were apparently secondary to pediculosis; while in 24, i.e., 5·5 per cent, the two infections were coincident.

The preponderating percentage of the pediculous cases is at once apparent. Of the remaining non-parasitic cases of pyodermia, seborrhœa—which is common, and of a severe type among our troops—accounts for the majority, whilst in only sixty-seven could no definite cause be assigned.

We are therefore justified in assuming that parasites are responsible to a very considerable degree for the disability induced by skin diseases in this War.

CONCLUSIONS.

(1) The disability produced by parasitic infection is very considerable. Of 669 cases admitted in just over five weeks, 442 were directly attributable to scabies and pediculosis.

(2) Of these 442, 171 were due to scabies alone, 24 to the combined infections, and 257 to pediculi.

(3) The *P. vestimentorum* is capable, and in a considerable majority of cases actually does lay its eggs in the hair of the pubis and perineum, and sometimes the axilla.

(4) From this fact there arises the important deduction that measures directed towards sterilization of the clothes cannot be efficient unless the host himself is also disinfected at the same time.

(5) We regard it as extremely probable that the lesions of pediculosis are initiated in susceptible individuals around the actual bite of the louse.

(6) The severity of the lesions produced, especially in the case of scabies, is very considerably aggravated by the seborrhœic diathesis.

(7) Rapid recovery in pyodermia, associated with either scabies or pediculosis, is the rule, provided that the respective causes are recognized and dealt with in an efficient manner.[1]

A QUICK METHOD OF DIAGNOSING THE TYPE OF MENINGOCOCCUS IN CASES OF CEREBROSPINAL FEVER.

By Major A. S. GORDON BELL.
Royal Army Medical Corps.
Of the Central Cerebrospinal Fever Laboratory.

AND

Miss I. M. HARMER.
Of the Central Cerebrospinal Fever Laboratory.

In the effective treatment of cerebrospinal fever early recognition of the type of the infecting meningococcus is of the utmost importance in order that the corresponding specific curative serum may be given as soon as possible.

Under the most favourable circumstances, forty-eight hours must elapse before the meningococcus can be grown from the cerebrospinal fluid or nasopharynx of the case and its correct type diagnosed by agglutination and not infrequently seventy-two hours pass before the infecting meningococcus is classed.

An attempt was made in the first place to shorten this period by substituting a precipitin for the agglutination reaction; it failed dismally. Finding that in the case of the four univalent agglutinating sera prepared from the rabbit and sent out from the Central Laboratory for identifying types of the meningococcus, the results given by complement fixation were practically identical with those obtained by agglutination, the writers next proceeded to apply the complement fixation test to serum taken from patients at an early stage of cerebrospinal fever, using the four standard type cocci as antigens in each instance. The results obtained in sixteen successive cases of cerebrospinal fever were as follows:—

It will be seen that in each of these sixteen cases except (*b*) the results were not clean cut; nevertheless the indication obtained by this method was proved right in all of the cases in which the type of the coccus could subsequently be

[1] We have been asked to explain the fact that whereas about ninety per cent of all troops in the trenches are infected with lice, only a relatively small proportion (the exact figures cannot, of course, be given) present the secondary lesions we have described. It can be contended that there is an individual susceptibility in some cases such as has been proved to exist in the case of flea-bites (Boycott), and those of mosquitoes and other insects.

In other cases the phenomenon of anaphylaxis probably plays a part; so that the susceptibility of the individual as evidenced by the appearance of the lesions is at first latent. That some specific toxin is injected by the louse when feeding is supported by the fact that in marked cases of melanodermia, associated with pediculosis, even the mucous membranes may become pigmented, as in Addison's disease (Thibierge and others). Darier, moreover, points out that it is not rare in such cases to find a marked cachexia with very real asthenia—a fact which we have ourselves observed on more than one occasion.

Another factor in the production of the secondary lesion is, in our opinion, the co-existence of the seborrhœic diathesis which, as we have already pointed out, plays such an important rôle in the severe eruptions primarily due to the *Acarus scabiei.*

No. of case	Day of disease	Type I: Dilutions of serum 1 : 50	Type I 1 : 100	Type I 1 : 200	Type II: Dilutions of serum 1 : 50	Type II 1 : 100	Type II 1 : 200	Type III: Dilutions of serum 1 : 50	Type III 1 : 100	Type III 1 : 200	Type IV: Dilutions of serum 1 : 50	Type IV 1 : 100	Type IV 1 : 200	Serum control 1 : 50	Type of coccus isolated from cerebro-spinal fluid or naso-pharynx
(a)	60	++	−	..	+++	+++	..	+	+	..	+	−	..	−	II
(b)	14	−	−	..	−	−	..	+++	+	..	−	−	..	−	III
(c)	5	+++	+++	++	−	−	−	+++	+++	(+)	−	−	−	−	I
(d)	27 ?	+++	++	+	++	++	(+)	++	++	(+)	++	++	(+)	−	I
	41 ?	+++	+	+	++	+	−	++	++	+	+	−	−	−	
(e)	5	+	−	−	+++	+	−	+++	++	−	++	−	−	−	III
	9	++	+	+	+++	++	+	+++	+++	+++	++	+	+	−	
(f)	30	+	−	..	++	+	..	(+)	−	..	(+)	−	..	−	II
(g)	35	..	+	−	..	++	−	..	++	−	..	++	(+)	−	II
(h)	3	(+)	(+)	−	+	+	−	−	−	−	+	(+)	−	−	..
	5	+	(+)	(+)	+++	++	(+)	+	+	−	++	+	(+)	−	
	28	(+)	−	−	++	+	−	++	−	−	−	−	−	−	
(i)	4 ?	+	−	−	++	++	−	+	−	−	++	+	−	−	..
(j)	4 ?	++	+	+	+++	++	++	++	+	+	+++	++	++	−	IV
(k)	..	..	++	+	..	+	−	..	+	−	..	(+)	−	−	..
(l)	6	+++	+++	+++	+	+	−	+++	+++	+	+	−	−	−	I
(m)	7	+++	+	+	++	(+)	−	++	(+)	−	++	(+)	−	−	I
(n)	10	+++	+++	+++	+	(+)	−	+++	+++	+++	++	+	−	−	I
(o)	4	++	(+)	−	+++	+	−	++	(+)	−	++	+	−	−	II
(p)	5	+++	+++	++	+++	+	−	+++	+	−	+++	++	−	−	I

In the above table +++ stands for complete complement fixation (absence of hæmolysis), and − for negative fixation (hæmolysis complete).

verified by agglutination of the culture isolated from the cerebrospinal fluid or nasopharynx of the patient. Contrary to the experience of some other workers it was found with one exception that there were too few antibodies in the patient's sera to produce agglutination with the four type emulsions.

Controls of normal serum from several sources were carried out in each instance and gave uniformly negative results.

Serum from four syphilitic and eight gonococcal cases also gave either negative results or very slight complement fixation and then only at a dilution of serum of 1 : 50. A sample of serum from a case (*i*) which subsequently was regarded to be one of tuberculous meningitis gave a positive result. The explanation is not yet clear.

The earliest day on which a positive result was obtained was the third, but the history may have been incorrect and this point needs verifying. The case indicated as (*h*) in the table shows the difference in antibody content of three specimens of blood collected on the third, fifth and twenty-eighth days of the disease respectively.

Technique.—Two different antigens have been made use of so far. At first suspensions of the stock cocci were used in a strength of 200 million organisms per cubic centimetre—this strength being chosen because an emulsion of 400 million per cubic centimetre was found to be slightly anticomplementary. Later at the suggestion of Captain Thomson of the Military Hospital Rochester Row, who has been studying the test in relation to gonococcus infection, an antigen was made by dissolving the cocci in NO_2 NaOH and bringing the solution back almost to the neutral point by the addition of NO_2 HCl. This antigen is used in a dilution equivalent to 100 million cocci per cubic centimetre. It is found to be a much more sensitive antigen than the stock suspension, though less specific with a serum rich in antibodies.

The patient's serum is tested in dilutions of 1 : 50, 1 : 100 and 1 : 200. It is found to be advisable to use all three dilutions for each test as the readings are not sufficiently clean cut for a single dilution only to be used.

A sheep hæmolytic system is used and complement is obtained from the ear of a guinea-pig.

In the titration of the complement the following method is followed. Increasing doses of a 1 : 10 solution of complement, viz., 0·15 cubic centimetre, 0·2 cubic centimetre, 0·25 cubic centimetre, etc., are added to tubes already containing antigen and 1 : 50 normal human serum in the proportions subsequently used in the actual test. These are incubated in the 37° C. water bath for half an hour before the hæmolytic couple is added. The exact amount of complement required to bring about complete hæmolysis under these conditions is then used in the test proper. A control is put up of the serum of the patient without the antigen and a further control of the antigens only.

Reviews.

INTRAVENOUS INJECTIONS IN WOUND SHOCK. By W. M. Bayliss. London: Longmans, Green and Co. 1918. Pp. xi + 172. Price 9s. net.

This volume is an amplification of the Oliver-Sharpey Lectures delivered by Professor Bayliss before the Royal College of Physicians, London, last year. It gives a most admirable account of the present state of our knowledge of wound shock and devotes particular attention to the methods, especially his own method of gum injection, which have been used to combat the low blood-pressure association with this condition.

The first part of the book is devoted to a consideration of the nature of wound shock, the effects produced by low blood-pressure, the relation of hæmorrhage to other concomitant factors such as muscle injury, exposure to cold, etc., and a full discussion of the fluids suitable for intravenous injection for the purpose of raising the arterial pressure. The latter part is devoted to the special colloidal solutions and the methods of carrying out the injection, etc.

The volume gives a clear and succinct account of the whole problem and with the short but excellent bibliography it should prove invaluable to all those who have to combat the condition.

The get up of the volume, printing, paper and illustrations (no less than fifty-nine in a volume of 170 pages) is "pre-war" in its quality.

WOUNDS OF THE PLEURA AND LUNGS. By R. Gregorie. University of London Press. Pp. xxiii + 222. Price 7s. 6d. net.

Among the most interesting of all the surgical developments in connexion with the war is that concerned with the treatment of wounds of the lungs and pleura. In the far-off days of peace the intrusion of a surgeon into the thoracic cavity, except for the purpose of removing fluid contained therein, was an unusual event. It was surrounded by vague perils; it had been wreathed in the endless verbiage of the German-speaking surgeons, and the subject had thereby become repellant to many. The war has shown among many other things that in no other surgical conditions has the Teutonic capacity for making easy things appear difficult been more amply illustrated. All the positive pressure apparatus and every negative pressure chamber are now known to be only hindrances to the smooth and easy performance of operations upon the chest cavity. Under either local anæsthesia, or general anæsthesia, skilfully induced and maintained, the pleural cavity can be opened deliberately, adhesions separated, foreign bodies removed, and the wound sutured, by the mere observance of those general surgical principles which hold good universally.

The surgical treatment of wounds of the pleura and lung has run along parallel lines in the French and British armies. At first there were diffidence, reluctance, incapacity in dealing with the injuries met with in battle. But by equal degrees in both armies surgeons were slowly convinced that in certain groups of cases active measures alone could bring about a reduction in the very heavy mortality. Cases of "open thorax," cases of external hæmorrhage from the lung threatening instant death, cases of large hæmothorax were all brought within the scope of deliberately planned operations with results which speedily justified active interference. In France the surgeon to whose teaching and practice we owe most is Pierre Duval. The present work is a record not only of the large personal experience of the authors, but of the scattered experiences of others

working in different fronts on the French lines. It is an excellent book, praiseworthy not only as a tribute to the individual industry and insight of its authors, but for the sane and temperate judgment which with few exceptions or none characterize their decisions.

The book opens with a description of the pathological anatomy of wounds of the lungs and pleura. It would have been an advantage if something could have been said in detail with regard to the physiological anatomy, the question of "negative pressure" in the thorax, and of the physical relations existing between the parietal and visceral surfaces of the pleura. The views of Moxon, as Macewan has shown, do not represent the whole truth; yet they appear still to prevail in many of the text-books of to-day. When hæmorrhage occurs into the pleural cavity, and is unable to escape, what happens to it in respect of coagulation? We all know the views of Elliott and Henry. It is interesting to compare them with those of the authors.

"Blood coagulates in the pleural cavity for two reasons. In the first place when the continuity of the endothelial lining is interrupted over too great an extent, as occurs in widely open wounds of the thorax, or with extensive parietal lesions, coagulation occurs. The blood also coagulates when the pleura is infected."

"On the other hand, a recent and aseptic hæmothorax in a closed pleura does not coagulate *in situ* and remains incoagulable if withdrawn by aspiration."

The symptoms which result from a wound of the thorax are described as being of two types. *Mild*, where the symptoms are slight and transient, and are the clinical corollary of penetrating wounds in which a bullet cleaving its way through the lung does little or no damage. This type, which forms one-third of the cases which reach a hospital, is responsible for the early belief in the benignity of chest wounds. *Severe*, where there are well marked shock, pallor, and profound bodily collapse, only the respiratory muscles being capable of action. Between these two every variety may be seen; and the infinite distress of the "open thorax" will never be forgotten by those who have seen it.

In both types the diagnosis of the lesion, either pleural or pulmonary, is difficult. The differential value of such signs as are present requires careful scrutiny; the difficulty of interpreting them is not seldom considerable. The value of X-ray examination is rightly appraised by the authors. There is a full discussion, based in large degree upon those which have taken place at the Society of Surgery in Paris, on the medical and surgical complications of gunshot wounds, and on their treatment. The paramount necessity of rest, the complete avoidance of any slightest movement, exertion or talking, is properly emphasized. In all cases of hæmothorax the fluid should be removed, "there is no danger in withdrawing the contents of the pleural cavity; there may be harm in leaving them"; conditions for aspiration are, they assert, most favourable between the eighth and twelfth days. The authors do not agree that there is any advantage in injecting air or oxygen into the pleural cavity as the fluid is evacuated; they have never met with a case of secondary hæmorrhage when aspiration has been performed between the eighth and twelfth days. In the British Army it was found safe to aspirate on the fourth day and the administrative advantages of this date were considerable, allowing of the transference of a patient to a base hospital before sepsis developed. Open drainage should only be practised when aspiration evacuates pus. In cases of hæmothorax the difficulties of deciding whether hæmorrhage is still continuing, is likely to continue further, and is therefore an immediate threat to life, are admirably discussed here.

The fallacy of many individual signs, or even of the grouping of several signs, is fully realized, and the conclusions reached are as follows: "If aspiration withdraws from the pleura fluid blood which coagulates in the syringe or in the test-tube, the pulmonary wound is still bleeding. It is necessary to operate.

"But if aspiration withdraws fluid-blood from the pleura which does not coagulate in the syringe or in the test-tube, the wound in the lung is no longer bleeding. There is no necessity to operate."

Should projectiles retained in the lung be removed immediately? We all know the opinion of Duval which leans towards the affirmative answer to this question. "Pulmonary wounds" he says, "should be regarded in the same light as any other, and treated on the same general lines." But there are certain differences. Lung tissue is the most capable in the body of tolerating the presence of foreign bodies, and of resisting infection, probably by all organisms, certainly by anaerobic organisms." It is not enough to state the problem briefly, for to say that "foreign bodies in the lungs have been known to produce serious and immediate effects, therefore every foreign body must be removed at once" would lead to a riot of useless and dangerous operations. The type of foreign body, the nature and situation of the wound and the local signs must all be taken into account. When the general symptoms are serious, attempts at intervention though possibly more necessary are indubitably more serious. The authors conclude that "up to the present the case for immediate removal of a foreign body scarcely rests on adequate grounds, yet its removal at a later date may be considered justifiable." But the problem is far from being solved.

Infection of the lung and pleura and late complications are also adequately and sincerely discussed. But, especially in respect of the latter, no final conclusions as to treatment can yet be reached.

The value of this little book is not proportioned to its size. In an admirable series it stands out as one of the very best in design, in knowledge, in wise judgment and in sound advice. For students of this new branch of surgery it is indispensable.

ESSENTIALS OF MEDICAL ELECTRICITY. By Elkin P. Cumberbatch. Henry Kimpton, London. 1919. Pp. xv + 368. Price 7s. 6d. net.

This valuable manual has now reached its fourth edition, which fact clearly indicates that it well meets the regular demand for a work descriptive of the uses of electricity in the treatment of disease, a demand accentuated markedly during war time.

With the exception of X-rays, it deals with all the various forms of application of electricity in medicine, and though this is in one sense rather a wide scope for a single volume, the author manages to condense into it a most clear and comprehensive explanation and description of the various methods employed and of the apparatus required.

The final chapter, by way of an appendix, contains a brief account of the physical principles of electricity. On p. 17 some explanation is attempted of terms used in speaking of electricity, but it is unfortunate that *amperage* should be there spoken of as the *strength* of a current, as this leads to, rather than avoids, the common confusion of amperage and voltage. Otherwise the explanations are good. Throughout the book similar explanations are given of the action of the various forms of treatment on the human organism so far as this is known, so that the book may well serve as an introduction to the subjects with which it deals.

In a preliminary chapter the author suggests that electricity as applied in treatment should be looked upon as an agent producing known chemical and physical effects. This should help to clear up the very hazy ideas prevalent regarding the mode of action of electricity in repair of morbid conditions, and should tend to render its use less empirical.

Chapter I explains the action of electricity on the body by describing the action of electrolytes, and thus gives the key to the later chapters.

The practice of ionization is described and electrical testing of nerve and muscle is fully described and discussed.

The subject of diathermy is more extensively discussed in view of later work in this form of treatment; its possibilities are suggested and the surgical dangers associated with its practice are pointed out. Unfortunately experience of this form of treatment is not yet sufficient to warrant dogmatic statements, and more discrimination might well have been exercised in drawing up the list of conditions classed as suitable for its employment.

The same criticism applies to the index of treatment forming a later chapter. The author safeguards himself by advising that electrical treatment should be used always in association with other lines of treatment indicated in particular cases, but even with that proviso it is a rather wide net that sweeps in such general conditions as rickets amongst conditions specially suitable for electrical treatment.

Apart from this universal tendency of the specialist to make his speciality too general in its application, the information in this book is well balanced, and provides an excellent guide to young workers in electro-medical practice.

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EXPERIENCES WITH INTRAVENOUS INJECTIONS OF QUININE AND ANTIMONY IN THE TREATMENT OF MALARIA.

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THE difficulties encountered in the treatment of malaria are so great, and the circumstances which modify the effects of treatment so numerous, that it seems to be of some importance to record the results of any considerable trial given to a method. In this disease deductions cannot be drawn from the results obtained in a few cases, and one of the desiderata at the present time is an increased record of observations [1]. The following is an account of experiences with intravenous injections of quinine bihydrochloride and antimony tartrate, from February, 1917, till July, 1918, in patients from the Salonika Army who had been transferred to a Malta hospital. The employment of antimony in malaria was suggested in January, 1917, by Rogers [2], who found that in three subtertian cases intravenous injection of antimony was followed by disappearance of the crescent form of the parasite from the circulating blood. He did not claim to have found a cure, but his experience led him to suggest a trial for antimony, and I think the treatment has sometimes been too precipitately regarded as a failure. Antimony has such a strong claim to a thorough trial on theoretical grounds, and especially in view of its success in kala-azar, that a large number of failures in practice are required to condemn it. As regards quinine, the tendency has been to regard its administration by the mouth as the routine method, and injection intramuscularly as suitable for more severe cases, and to reserve intravenous injection for the patients who are dangerously ill. An official handbook [3] advises quinine by the mouth as a routine, but " in ordinary cases where there is much gastric disturbance or where the drug appears to be failing to act when given by the mouth,

recourse should be had to intramuscular injections"; and again, "in pernicious infections and comatose cases, the intravenous route is undoubtedly that to be preferred." Some recent writers [4], however, have no doubt as to the superior efficacy of quinine when given intravenously, and have found no serious objection to its use in this way.

The cases under trial fell into two categories, the simple tertian and the subtertian. In the former an attempt was made to prevent the occurrence of relapses, and in the latter to cause the disappearance from the circulating blood of the sexual form of the parasite. The problem in tertian malaria is not to cure an attack, which will end of itself, nor to prevent an attack within two days or four days or six days, because quinine in sufficient doses will ensure this; the problem is to treat the patient in such a way that relapses will not occur at some more distant date: that is to say, one is looking for a treatment which will kill all the parasites in the body in whatever stage or form they may be, without injury to the tissues of the host. Not only is this difficult to do, but in tertian malaria there is a special difficulty in knowing whether one has done it. Blood examination, unfortunately, is not of much assistance. During an attack, or between successive attacks, parasites can nearly always be found in blood-films, but quinine causes them quickly to disappear, sexual forms as well as vegetative. If another attack occurs some time after, they can be found again as a rule, but their absence from films at any particular moment is no indication that a relapse will not occur. The success or failure of treatment must be judged by the occurrence or absence of relapse.

Quinine by itself in ordinary doses does not seem to have much effect in eradicating parasites, though a daily intravenous dose of fifteen grains for three or four days will arrest any series of attacks of tertian malaria, sometimes for a considerable period. For instance, a man with a double tertian infection who had had fourteen successive attacks in fourteen days, remained free from malaria for fifty-nine days after three injections of fifteen grains of the bihydrochloride intravenously. This patient vomited quinine when given in solution by the mouth, and during the fourteen days with pyrexia had had thirty grains daily in tablet form. Such an experience with intravenous injection is common, yet most of the patients relapse after a longer or shorter period. In 1917 I had an opportunity of treating a number of chronic relapsing tertian cases with a view to preventing relapses. Unfortunately, from the medical point of view, in dealing with the soldier one cannot always conduct ones experiments in the way most likely to give the most definite scientific results, because men must be returned to service as soon as possible. With this series I decided to try the effect of three intravenous injections of fifteen grains of quinine bihydrochloride and five intravenous injections of antimony tartrate in doses up to 0·12 gramme, these being given on eight successive days. What one would have liked to do was to treat some cases by quinine, others by antimony, and perhaps a third set by combination, but it was not found practicable to treat and keep under

observation sufficiently large numbers if they were divided into three groups. The number of patients treated was 104, and the period of treatment and observation extended from June till December, 1917. They were all chronic relapsers. Fifty-six out of 104 were of more than a year's standing, and fifty had had thirty relapses or over. The average duration of the cases was eleven months, and few of them had done much duty since their illness began, the average amount performed in these eleven months being a month and a half. The average number of relapses per patient had been twenty-five. The three highest numbers of relapses in the three months before treatment were 32, 23, and 17, while the average over all was 7. Three months was fixed on as a period for keeping them under observation, and the simplest method of finding a control seemed to be to compare the number of attacks occurring in the three months preceding treatment with the number in the three months which followed it. In theory, the number of attacks a patient has had is not necessarily a guide to the severity or intractability of his infection, because the number tends to vary inversely as the vigour of the treatment, but probably in practice, with patients for the most part in hospital under similar conditions, the number of attacks can be used as an index of the severity of the infection, and also for the comparison of one case with another. I did not pay much attention to the number of attacks occurring in the period after treatment, but considered chiefly whether or not any relapse occurred. If a relapse occurred at all, then the case was to be considered a failure.

I have mentioned that eight injections were given in this series of cases. The first thirty patients had three doses of quinine and then five of antimony, the remainder had quinine on the second, fourth, and sixth days, and antimony on the others. On the days on which antimony was injected thirty grains of quinine sulphate were given by the mouth. Thereafter, during the three months of observation the patients had six grains of quinine daily by the mouth. This was found necessary in order to comply with the orders which had been laid down for the treatment of cases of malaria, and I should think had little effect in preventing the occurrence of relapses. To such chronic relapsers a small dose of quinine makes not much difference, and in any case most of them had been on quinine from the beginning of their illness, so that the numbers of the attacks before and after treatment were comparable in this respect. After treatment they were sent to a camp hospital where they did a certain amount of light duty, and had to go about a good deal in the sun, a thing which in itself has a great effect in bringing on malarial relapses.

Of the 104 patients, 57 remained free from relapse for the period of three months, 12 had one relapse, and 35 more than one relapse. The number remaining free was about fifty-five per cent. Three months seems to have been a reasonable time to take as a standard, because I did not come across more than one case in which a first relapse occurred after a longer interval than ninety days.

On coming to look into these cases of relapse, however, one found that the matter could not be summarily disposed of with the statement that those who did not relapse were successes, and those who did relapse failures. A difficulty arose in deciding what was to be reckoned a relapse. Ordinarily it is not difficult to say whether or not a patient with tertian malaria is having an attack. He has a rigor and a high temperature, and parasites are usually to be found in the blood. But with these treated patients the subsequent attacks often did not show a temperature higher than 99° or 100° F., and frequently parasites could not be found in the blood. Are these to be reckoned as malarial attacks or not? They have been happily described by Colonel Sir A. Garrod as malarial *petit mal*. In estimating results I have reckoned any pyrexia of 99° F. or over, accompanied or preceded by a rigor, as a malarial attack, even if the blood examination was negative. If, however, these are genuine attacks, then the number of negative films is remarkable. Here is a comparison. In the spring of 1917, a number of convalescents in camp who were awaiting passage to active service happened to be called out unexpectedly for picket duty. Most of these men had been cases of tertian malaria, but were all considered to be recovered sufficiently to be sent back to active service. The weather was warm, they were exposed to the sun, and many had attacks. Out of fifty who were admitted to one hospital in a period of five days, parasites were found in the blood of forty-five. On the other hand, sixty-two blood-films from treated patients reckoned as relapses according to the criterion mentioned showed parasites in only twenty-five, that is, in forty per cent as compared with ninety per cent of the others. In both series the blood was examined in thick films, and there was no question of the films being negative through administration of quinine. In ordinary cases, provided no quinine is given between the beginning of the rigor and the time the film is made, quinine taken before the rigor is not likely to make the film negative. This is one's experience in examining cases in the wards. Patients who had been treated, themselves often said that these relapses were less severe and different from those they had experienced previously. Not all, however, were of this modified type. Some patients had downright relapses, for insance: (1) Rigor, temperature 105° F., parasites in blood-film; (2) rigor, temperature 103° F., parasites in blood-film.

The following table shows the best results obtained in this series of cases:—

TABLE I.

Patient No.	11	30	32	64	73	80	85	92	102
Since first attack (months) ..	8	13	9	9	13	12	12	14	15
Duty since first attack (months)	0	4	2	0	0	6	1	1	0
Total number of attacks ..	40	50	40	20	40	40	40	50	50
Number of attacks in three months before treatment ..	17	12	10	14	18	11	12	12	7
Number of attacks in three months after treatment ..	0	0	0	0	0	0	0	0	0

Several of these men were seen again after a longer interval than three months, and all had remained free from malaria. No. 11 after six months, No. 32 after four months, No. 64 after twelve months, No. 80 after five months, and No. 92 after six months. The patient mentioned as having had thirty-two attacks in the three months before treatment was considered to have relapsed. On two occasions he had a temperature of 99° F., accompanied by rigor, within a month of the conclusion of treatment, but thereafter he remained free for four months, when he went again on active service. The worst results are shown in Table II.

TABLE II.

Patient No.	7	12	28	34
Since first attack (months)	12	2	12	9
Duty since first attack (months)	0	0	0	0
Total number of attacks	30	6	9	15
Number of attacks in three months before treatment	7	6	3	7
Number of attacks in three months after treatment	4	3	6	5

As regards the general health of these 104 patients, there is not much to be said. It was for the most part fairly good. Most tertian patients are well between their attacks. Many of these men complained both before and afterwards of pains in the head. They were exposed to the sun a good deal in the camp to which they were sent after treatment, and this may have accounted for some of it: but the complaint is a common one in tertian malaria. The patient is not always the best judge of his own condition, and results that can be put into figures are therefore more valuable than general impressions.

Less satisfactory results were obtained with a few cases treated in a similar way in the early spring of 1918. Most of them relapsed. Of a number of cases treated about the same time with a longer course of injections of antimony and quinine (mostly five doses of quinine and five of antimony, followed six or seven days later by one of quinine and two of antimony) only four out of thirteen who remained under observation for three months did not relapse. The malarial organism is most active in the body in the spring season and this may have had something to do with the less favourable results.

A few tertian cases remain to be considered which were treated with antimony alone. Four men were picked out who had been treated with quinine and antimony in 1917, and who were still relapsing. They were given injections (eleven to twelve) of antimony tartrate, one every third day, beginning with 0·04 gramme, and increasing in three cases to 0·13 gramme. In the case of the fourth the maximum dose given was 0·07 gramme, as it was found that 0·08 gramme made him vomit. Two of these patients were apparently cured, the third had a doubtful attack (this was the patient who had had the small doses), and the fourth showed no improvement, but continued to relapse. This last had to be given quinine, but the three others had no quinine after the commencement of the course

of antimony treatment. Two other patients, both with an idiosyncrasy to quinine, were treated with antimony only. (Their cases are referred to in the section on the method of injection.) One of them had had malaria for six months, and had had sixteen attacks, eight in the three months preceding treatment. He was given fifteen injections of antimony tartrate, up to 0·13 gramme, a dose being given every third day. During the month and a half in which he was under treatment parasites were found in his blood in eighteen out of thirty-four examinations, yet he had no definite attacks, and his highest recorded temperature was 100·2° F. He looked better, and said he felt better as a result of treatment, and in the five months which followed he had no attacks. The second patient had had twelve attacks in the five months before treatment, and was relapsing every second day at the time the injections of antimony were commenced. He was treated similarly to the other over a course of thirty-nine days, but had twelve attacks in the first twenty-four days. Thereafter his temperature remained normal until he was sent to England thirty-two days later. In this case it was noticed that the cycle of the parasite occupied forty-eight and three-quarter hours. Parasites were found in the blood daily while these relapses were taking place. In fourteen subsequent examinations, when the temperature was normal, parasites were found five times.

The position of quinine in the treatment of simple tertian malaria may be summed up in this, that for immediate treatment it is very satisfactory, but for eradication of the disease unsatisfactory. A period of freedom follows intravenous injections, but cure in the relapsing cases is exceptional, and when relapse occurs, it is a fully developed attack, with parasites present in the circulating blood. It is not easy to interpret the results obtained with antimony. Certainly antimony has no such immediate effect in stopping attacks as quinine; but it is difficult to see to what some of the subsequent results obtained are to be attributed if not to the action of antimony. I refer particularly to the stoppage of relapses in a certain number of cases, the occurrence of a modified form of attack in others, and the quite unusual number of instances in which films of the circulating blood showed no parasites. I believe that antimony has some lasting effect on the malarial organism. Probably it requires to be given over a considerable period of time before its action becomes apparent. This has been found in Malta in cases of kala-azar treated with antimony tartrate [5]. There are two possible views with regard to the origin of relapses. The first is that forms of the parasite are developed which are resistant to the action of quinine; the second, that some of the parasites get into parts of the body in which drugs fail to reach them. There is some evidence against the former view, and there are analogies in favour of the latter. Against the idea of resistant forms is the fact that all parasites disappear from the blood when quinine is given, and even after a patient has had a long course of treatment one does not find any forms present in the blood

which are able to resist the action of quinine. The parasite is apparently unable to acquire an immunity against it. The analogies referred to in favour of parasites in inaccessible situations include those of diphtheria bacilli in the tonsillar crypts of diphtheria carriers, and typhoid bacilli in the gall-bladders of patients after typhoid fever. In both these cases the difficulty is not to find a chemical which will kill the bacilli, but to make it reach them. If the case of the malaria parasite is analogous to these, the outlook for the solution of the problem is less hopeful than if one were concerned only with quinine-resisting forms. A line of treatment to which one would like to see an extending trial given is the intravenous injection of three or four doses of quinine immediately after the first attack, whether this be slight or severe. At this stage one might hope that all the parasites would be sufficiently accessible to be killed by the injection. The mode of action of antimony is too obscure to allow its value to be decided by a few cases such as these described, but I think it deserves a persistent trial in a large number of chronically relapsing cases. The patients who have come under observation and treatment in Malta are nearly all chronic cases who have been invalided because of the stubbornness of their disease, and those chosen for the purpose of these experiments have been some of the worst. The results with the patients who have been treated, therefore, are not likely to have been unduly favourable from lightness of the infection. A factor to be taken into account in estimating results is the season at which treatment is carried out. In the Mediterranean, at least, relapses tend to occur with greater frequency, and in a form more difficult to control, in the spring than at any other time, and this seems to be independent of the time of year at which infection took place. It has been a common experience in Malta to have patients transferred in winter with subtertian malaria, and with their blood full of subtertian parasites, and then about March to find these same patients free from subtertian parasites, but with typical tertian attacks, and with tertian parasites in the blood. The men themselves often notice the change in the character of the attacks. Local infection can be definitely excluded, and their occurrence is to be attributed to a seasonal cyclical increase of vitality in a hitherto dormant parasite.

In dealing with the action of quinine given intravenously in subtertian malaria one is on firmer ground. The symptoms differ widely from those of tertian, the temperature for the most part being a moderate irregular pyrexia of indefinite duration. Some of the cases are so slight that the patient is unaware he has malaria; others are fatal, and the symptoms of severe cases may resemble those of severe typhoid fever. Blood examination in this form of malaria is of the greatest assistance. If the patient is suffering from the disease, even though his temperature may be only slightly elevated, parasites are likely to be found in his peripheral circulation, whether or not he is taking quinine by the mouth. The number of the ring forms of the parasites in blood-films is roughly a measure of the

severity of the attack. In addition to the rings, the crescentic sexual forms are frequently present. If no rings are to be found, a patient is not likely to feel ill from the presence of even large numbers of crescents, and it is the general experience that variation in the number of crescents is not produced by the giving of quinine. The ring forms can be directly controlled by quinine, but it is for the purpose of getting rid of the crescents that antimony injections have been tried. The effect of quinine given intravenously in pyrexial cases of subtertian malaria is one of the most striking things in therapeutics. After three intravenous injections of fifteen grains of quinine bihydrochloride a patient may be found reading, and with a normal temperature, whose temperature previously was elevated, and who was pale and vomiting, and possibly delirious. One has seen delirious patients with cerebral malaria make remarkable recoveries after four or five eight-hourly intravenous injections of ten grains of quinine: but this is generally accepted as a universal experience. Any other method of administration in such cases is not to be thought of. Indeed, it is often in spite of quinine given by the mouth that these patients have got into this condition. An unusual proportion of patients with subtertian malaria are unable to take quinine by the mouth without vomiting. In many instances this is a symptom of the disease, due to the toxic action of the malarial poison. These are cases in which three or four daily intravenous injections of fifteen grains of the bihydrochloride are invaluable. The patient stops vomiting, his temperature falls, and he can often afterwards take quinine by the mouth. If such patients are subsequently given adequate oral doses (thirty grains a day to begin with) most of them go on uninterruptedly to recovery. If relapse occurs, the injections can be repeated, and it is an interesting fact that in case of relapse they often ask for more injections. This is a good testimonial as the injection of quinine is unpleasant. I think that every case of subtertian malaria with rings in his blood should be treated by quinine intravenously. It will shorten his illness and stay in hospital, and will also save much quinine. The presence of nephritis as a complication is no bar to the injection of quinine. In several cases of nephritis associated with severe malaria which came under observation, the patients' general condition greatly improved after intravenous treatment. The amount of albumin in the urine was not appreciably altered, but blood disappeared from the urine of two of them.

When we come to test the value of antimony in destroying the crescent form of the parasite, we are once again faced with difficulties. There is no difficulty in counting the crescents in thick films, and a convenient way of recording them is to write down the number found per hundred leucocytes. The leucocytes may be counted once to make sure that their number is about normal. In any case the number put down for the crescents is only very approximate. More information is wanted as to the variation in the number of crescents apart from the action of drugs. What is apt to happen is this. One finds a case with crescents and counts

them daily, waiting for a suitable opportunity to begin treatment. Before this comes, the crescents may have disappeared. In five cases I had under observation the crescents disappeared from the blood apparently spontaneously. The following table (Table III) shows the variations in the crescents from day to day in six cases, over a considerable number of days. These patients had quinine in varying doses at different times, but as it apparently exercised no influence over the number of their crescents, I have omitted it from the table.

TABLE III.—Daily Observation of Number of Crescents in Blood (no Antimony given).
(*Number of Crescents per 100 Leucocytes. Rings marked only where Present.*)

Case 2.

Day of observation	Crescents	Rings	Day of observation	Crescents	Rings	Day of observation	Crescents	Rings
1	+	+	20	—	..	39	—	..
2	+	+	21	—	..	40	—	..
3	+	..	22	—	..	41	—	..
4	+	..	23	—	..	42	—	..
5	+	..	24	—	..	43	—	..
6	+	..	25	—	..	44	—	..
7	+	..	26	0·5	..	45	—	..
8	+	..	27	—	..	46	—	..
9	—	..	28	—	..	47	—	..
10	+	..	29	—	..	48	—	..
11	+	..	30	—	..	49	—	..
12	—	..	31	—	..	50	—	..
13	—	..	32	—	..	51	—	..
14	+	..	33	—	..	52	—	..
15	+	..	34	—	..	53	—	..
16	+	..	35	—	..	54	—	..
17	+	..	36	—	..	55	—	..
18	+	..	37	—	..		and for 16	
19	+	..	38	—	..		days more	

Case 4.

Day of observation	Crescents	Rings	Day of observation	Crescents	Rings	Day of observation	Crescents	Rings
1	1	+	18	1	..	35	..	..
2	3.5	+	19	1	..	36	—	..
3	6	+	20	0.5	..	37	..	..
4	3	..	21	—	..	38	—	..
5	4	..	22	—	..	39	..	..
6	2·5	..	23	—	..	40	—	..
7	2·5	..	24	—	..	41	..	..
8	1·5	..	25	—	..	42	—	..
9	1	..	26	—	..	43	..	..
10	1	..	27	—	..	44	—	..
11	0·5	..	28	—	..	45	..	..
12	1	..	29	—	..	46	—	..
13	0·5	..	30	—	..	47	..	..
14	1·5	..	31	—	..	48	—	..
15	0·5	..	32	—	..	49	..	..
16	1	..	33	—	..	50	—	..
17	—	..	34	—	..			

TABLE III.—*Continued.*

CASE 6.

Day of observation	Crescents	Rings	Day of observation	Crescents	Rings	Day of observation	Crescents	Rings
1	4	+	12	3	..	23	0·5	..
2	7·5	+	13	—	..	24	—	+
3	8	..	14	—	..	25	—	..
4	7	..	15	1	..	26	—	..
5	4	..	16	1	..	27	—	..
6	2	..	17	1	..	28	—	..
7	1	..	18	1	..	29	0·5	..
8	2	..	19	1	..	30	—	..
9	4·5	..	20	1·5	..	31	—	..
10	4	..	21	—	..	32	—	..
11	—	+	22	0·5	+	33	—	..

CASE 7.

Day of observation	Crescents	Rings	Day of observation	Crescents	Rings	Day of observation	Crescents	Rings
1	—	+	10	—	..	19	—	..
2	—	+	11	0·5	..	20	—	..
3	1	..	12	0·5	..	21	—	..
4	—	..	13	0·5	+	22	—	..
5	—	..	14	0·5	..	23	..	..
6	—	..	15	—	..	24	—	..
7	—	+	16	—	..	25	—	..
8	1·5	..	17	—	..	26	—	..
9	—	..	18	—	..	27	—	..

CASE 8.

Day of observation	Crescents	Rings	Day of observation	Crescents	Rings	Day of observation	Crescents	Rings
1	7	+	12	—	..	23	—	+
2	..	..	13	2	..	24	—	..
3	..	..	14	—	..	25	—	..
4	1·5	+	15	2·5	..	26	—	..
5	1·5	+	16	0·5	..	27	—	..
6	0·5	+	17	0·5	..	28	—	+
7	1	+	18	1·5	..	29	—	..
8	—	+	19	0·5	..	30	—	..
9	1	+	20	—	..	31	0.5	..
10	—	+	21	—	+	32	—	..
11	0·5	..	22	—	+			

TABLE III—*Continued.*

CASE 13.

Day of observation	Crescents	Rings	Day of observation	Crescents	Rings	Day of observation	Crescents	Rings
1	3·5	+	20	0·5	..	39	0·5	..
2	2	+	21	1	..	40	—	+
3	2	+	22	0·5	..	41	—	..
4	1·5	..	23	1	..	42	—	+
5	0·5	..	24	0·5	..	43	1	..
6	3·5	..	25	1	..	44	0·5	..
7	3	..	26	—	..	45	1·5	..
8	0·5	..	27	1	..	46	0·5	..
9	2	..	28	—	..	47	1	..
10	1·5	..	29	0·5	..	48	—	..
11	1	..	30	0·5	..	49	0·5	..
12	1	..	31	0·5	..	50	—	+
13	3	..	32	1	..	51	1·5	..
14	0·5	..	33	—	+	52	—	+
15	2·5	..	34	—	+	53	1·5	+
16	1·5	..	35	—	+	54	1	+
17	2	..	36	—	+	55	—	..
18	1	..	37	—	+			
19	2·5	..	38	—	+			

Eight patients were treated by intravenous injections of antimony tartrate, and may be mentioned shortly.

(1) *Patient No.* 1.—Admitted to hospital in January, 1917, suffering from severe burns. Pyrexia which he afterwards developed was found to be due to subtertian malaria. He was given quinine sulphate by the mouth (up to thirty grains a day) for nine days from February 17, and no more quinine up to the time of his leaving hospital in December. From February 21 crescents were present in the blood daily. Injections of antimony tartrate were begun on February 26, and seven doses were given, the last on March 8. Crescents continued to be present in blood-films until March 11, three days after the injections had been stopped. They then disappeared and were not found again in frequent examinations made up to June. He was still well in December.

(2) *Patient No.* 3, a case who was known to have had crescents forty days before admission. The blood was examined first on March 16, and showed rings and crescents (21 per 100 leucocytes). He was put on thirty grains of quinine sulphate daily, by the mouth, on March 17, and continued to have it till May 18. From May 19 till June 13 he had twenty grains a day. Rings disappeared two days after quinine by the mouth was begun, but crescents persisted. On March 22 they reached 27 per 100 leucocytes. Subsequent days showed 19, 11, 10, 10, 3, 6, 4, 1, 2. They continued to be present, however, till May 15 when rings re-appeared for six days, during which crescents were found only once. When the rings disappeared crescents were found again each day. From May 1 to 5 a daily injection of

antimony tartrate was given. On May 2, 3, and 4, both rings and crescents were present; but from May 8 till June 13, when he went to convalescent camp, no crescents were found.

(3) *Patient No.* 5, an R.A.M.C. officer, who had suffered from subtertian malaria for seven months, and who had had forty intramuscular injections of quinine. He was examined first on April 22, and had crescents daily in his blood. Five doses of antimony were given from April 25 till April 29. For eight days from April 30 no crescents were found. He was then invalided to England.

(4) *Patient No.* 9 had been sick only three weeks at the time of his admission to hospital in Malta on December 9. Rings and crescents (four) were found in his blood. He was put on quinine by the mouth, and on December 11 rings had gone, and crescents numbered 46 per 100 leucocytes. On December 12, 13, and 14 he was given fifteen grains of quinine bi-hydrochloride intravenously. From December 11 till December 19 crescents numbered 46, 48, 49, 29, 53, 56, 46, 52, and 43. On December 20 antimony treatment was begun, and a dose given daily for five days. During these days crescents were 37, 36, 54, 22, 9, per 100 leucocytes. On the days following treatment the numbers were 12, 4·5, 8·5, 1, 0·5. 0, 0·5, 0, 0·5, 0, and he was still free when he passed out of observation, forty-seven days later.

(5) *Patient No.* 10 had malaria for two months before admission on December 29. Rings and crescents were present. In the first fourteen days under observation rings disappeared after quinine had been given, but crescents persisted. From January 13 to January 17 a daily injection of antimony was given. Crescents were absent from the blood for the first time on January 24, and from that date till February 21, when he left for England, they were found three times, the last being on February 5. Rings, however, reappeared before he left hospital.

(6) *Patient No.* 11 had been six months in hospital before he was transferred to Malta. Rings and crescents were present in the blood on December 30. Rings disappeared when quinine was given, but crescents were found daily, the highest number being 11·5 per 100 leucocytes. From January 13 to 17 five doses of antimony were given. Crescents had disappeared on January 18, and were still absent when he left hospital ten days later.

(7) *Patient No.* 12 had been in bed for four months with malaria. Rings and crescents were present on December 26, and crescents were found each day till January 12. From January 13 to 17 five doses of antimony were given. Crescents disappeared on January 15, and his blood was still free when he left hospital on January 27.

(8) *Patient No.* 14 had had malaria for about nine months. Rings and crescents were found on December 26. Thereafter crescents were absent on three days till January 12. From January 13 to 17 five doses of antimony were given. The blood was free from crescents till February 9,

when they reappeared, and they were present on five days before he left hospital on February 20.

The details of these eight cases are shown in Table IV.

In this table the quinine given has not been shown. An interesting point is that frequently when rings appeared in the circulation crescents disappeared: (Table III, Case No. 6, days 11, 24; Case No. 7, days 1, 2; Case No. 8, days 8, 10; Case No. 13, days 33-38, 40, 42, 50, 52. Table IV, Case No. 3, days 31, 33-36).

As regards the action of antimony in these cases, it would seem to have some effect in destroying the crescents. Probably five injections on successive days were too little, and not spread over a sufficient period of time, but no further suitable cases for experiment came to hospital. Case No. 3 is striking. This patient was known to have had crescents in his blood for forty-six days before treatment, and only once, three days later, after the treatment by antimony had been carried out. The case which was least successful (No. 14) was also the most chronic. He had been ill for nine months before coming to hospital in Malta. Patient No. 1 had seven injections in eleven days, and was known to be well and free from parasites ten months later. The results of the injections of antimony in these cases, though not conclusive, justify the hope, I think, that more definite results might be obtained from a more thorough trial with a larger number of patients.

TABLE IV.—Daily Observation of Number of Crescents in Blood (Antimony given).
(*Number of Crescents per 100 Leucocytes. Rings marked only where Present.*)

Case 1.

Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings	Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings
1	..	+	..	21	..	—	..
2	..	+	..	22	..	—	..
3	..	+	..	23	..	—	..
4	..	+	..	24	..	—	..
5	..	+	..	25	..	—	..
6	0·04	+	..	26	..	—	..
7	..	+	..	27	..	—	..
8	0·08	+	..	28	..	—	..
9	..	+	..	29	..	—	..
10	0·12	+	..	30	..	—	..
11	..	+	..	31	..	—	..
12	0·13	+	..	32	..	—	..
13	..	+	..	33	..	—	..
14	0·12	+	..	34	..	—	..
15	0·12	+	..	35	..	—	..
16	0·12	+	..	36	..	—	..
17	..	+	..	37	..	—	..
18	..	+	..	38	..	—	..
19	..	+	..	39	..	—	..
20	..	—	..				

TABLE IV.—*Continued.*

CASE 3.

Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings	Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings
1	..	21	+	41	..	3·5	..
2	..	22	+	42	..	3	..
3	..	14	..	43	..	1	..
4	..	14·5	..	44	..	3	..
5	..	16	..	45	..	3	..
6	..	11·5	..	46	..	2	..
7	..	27	..	47	0·04	3	..
8	..	19	..	48	0·08	2·5	+
9	..	11	..	49	0·12	3·5	+
10	..	10	..	50	0·12	1	+
11	..	10·5	..	51	0·12	—	..
12	..	3	..	52	..	—	..
13	..	6	..	53	..	—	..
14	..	4·5	..	54	..	0·5	..
15	..	1	..	55	..	—	..
16	..	2	..	56	..	—	..
17	..	0·5	..	57	..	—	..
18	..	0·5	..	58	..	—	..
19	..	3	..	59	..	—	..
20	..	3·5	..	60	..	—	..
21	..	4·5	..	61	..	—	..
22	..	4·5	..	62	..	—	..
23	..	1·5	..	63	..	—	..
24	..	2	..	64	..	—	..
25	..	4	..	65	..	—	..
26	..	1	..	66	..	—	..
27	..	1·5	..	67	..	—	..
28	..	0·5	..	68	..	—	..
29	..	0·5	..	69	..	—	..
30	..	0·5	..	70	..	—	..
31	..	—	+	71	..	—	..
32	..	1	+	72	..	—	..
33	..	—	+	73	..	—	..
34	..	—	+	74	..	—	..
35	..	—	+	75	..	—	..
36	..	—	+	76	..	—	..
37	..	0·5	..	77	..	—	..
38		0·5	..	78	..	—	..
39	..	0·5	..	79	..	—	..
40	..	2	..			—	

CASE 5.

Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings	Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings
1	..	1	..	9	..	—	..
2	..	3	..	10	..	—	..
3	..	0·5	..	11	..	—	..
4	0·04	0·5	..	12	..	—	..
5	0·08	—	..	13	..	—	..
6	0·12	0·5	..	14	..	—	..
7	0·12	0·5	..	15	..	—	..
8	0·12	0·5	..				

TABLE IV.—*Continued.*

CASE 9.

Days of observation	Antimony tartrate, grm. intravenously	Crescents	Rings	Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings
1	..	4	+	24	..	—	..
2	..	..	..	25	..	0·5	..
3	..	46	..	26	..	—	..
4	..	48	..	27	..	—	..
5	..	49	..	28	..	—	..
6	..	29	..	29	..	—	..
7	..	53	..	30	..	—	..
8	..	56	..	31	..	—	..
9	..	46	..	32	..	—	..
10	..	52	..	33	..	—	..
11	..	43	..	34	..	—	..
12	0·04	37	..	35	..	—	..
13	0·08	36	..	36	..	—	..
14	0·12	54	..	37	..	—	..
15	0·12	22	..	38	..	—	..
16	0·12	9	..	39	..	—	..
17	..	12	..	40	..	—	..
18	..	4·5	..	41	..	—	..
19	..	8·5	..	42	..	—	..
20	..	1	..	43	..	—	..
21	..	0.5	..	44	..	—	..
22	..	—	..	45	..	—	..
23	..	0·5	..				

CASE 10.

Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings	Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings
1	..	3·5	+	28	..	0·5	..
2	..	..	..	29	..	—	..
3	..	2·5	+	30	..	—	..
4	..	5	+	31	..	0·5	..
5	..	1·5	+	32	..	—	..
6	..	2	..	33	..	—	..
7	..	3·5	..	34	..	—	..
8	..	3	..	35	..	—	..
9	..	4	..	36	..	—	..
10	..	2	..	37	..	—	..
11	..	2	..	38	..	..	..
12	..	2	..	39	..	1	..
13	..	6·5	..	40	..	—	..
14	..	3·5	..	41	..	—	..
15	..	4	..	42	..	—	..
16	0·04	4	..	43	..	—	..
17	0·08	5	..	44	..	—	..
18	0·12	5·5	..	45	..	—	..
19	0·12	2	..	46	..	—	..
20	0·12	5	..	47	..	—	+
21	..	6	..	48	..	—	+
22	..	1·5	..	49	..	—	+
23	..	1·5	..	50	..	—	+
24	..	0·5	..	51	..	—	+
25	..	2	..	52	..	—	+
26	..	0·5	..	53	..	—	+
27	..	—	..	54	..	—	+

TABLE IV.—*Continued.*

CASE 11.

Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings	Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings
1	..	3·5	+	15	..	4	..
2	..	..	..	16	0·04	1·5	+
3	..	8	..	17	0·08	—	..
4	..	11.5	..	18	0·12	0·5	..
5	..	4·5	..	19	0·12	0·5	+
6	..	6·5	..	20	0·12	—	+
7	..	3	..	21	..	—	—
8	..	8	..	22	..	—	..
9	..	3	..	23	..	—	..
10	..	2·5	..	24	..	—	..
11	..	2·5	..	25	..	—	..
12	..	3	..	26	..	—	..
13	..	3	..	27	..	—	..
14	..	1·5	..	28	..	—	..

CASE 12.

Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings	Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings
1	..	4·5	+	17	..	1	..
2	..	7	+	18	..	0·5	..
3	..	4·5	+	19	0·04	2	..
4	..	1	+	20	0·08	1	..
5	..	3·5	..	21	0·12	—	..
6	..	7·5	..	22	0·12	—	..
7	..	2·5	..	23	0·12	—	..
8	..	3	..	24	...	—	..
9	..	1·5	..	25	..	—	..
10	..	1	..	26	..	—	..
11	..	3·5	..	27	..	—	..
12	..	2·5	..	28	..	—	..
13	..	3	..	29	..	—	..
14	..	0·5	..	30	..	—	..
15	..	0·5	..	31	..	—	..
16	..	0·5	..	32	..	—	..

CASE 14.

Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings	Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings
1	..	4·5	+	29	..	—	..
2	..	8·5	+	30	..	—	..
3	..	2·5	+	31	..	—	..
4	..	4	+	32	..	—	..
5	..	0·5	..	33	..	—	..
6	..	1	..	34	..	—	..
7	..	2·5	..	35	..	—	+
8	..	1·5	..	36	..	—	+
9	..	—	..	37	..	—	+
10	..	2·5	..	38	..	—	..
11	..	—	..	39	..	—	..
12	..	2	..	40	..	—	..

TABLE IV, CASE 14.—*Continued.*

Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings	Day of observation	Antimony tartrate, grm. intravenously	Crescents	Rings
13	..	1·5	..	41	..	—	..
14	..	0·5	..	42	..	—	..
15	..	1	..	43	..	—	..
16	..	1·5	..	44	..	—	..
17	..	1	..	45	..	0·5	..
18	..	—	..	46	..	0·5	..
19	0.04	2	+	47	..	1	..
20	0·08	0·5	+	48	..	0·5	..
21	0·12	1	..	49	..	—	..
22	0·12	—	..	50	..	—	..
23	0·12	1	..	51	..	—	..
24	..	—	..	52	..	0·5	..
25	..	—	..	53	..	—	..
26	..	—	..	54	..	0·5	..
27	..	—	..	55	..	..	..
28	..	—	..	56	..	—	..

METHOD OF INJECTION.

The amount of quinine generally given in one intravenous injection is fifteen grains of the bihydrochloride. This may be given diluted three hundred times, as an official handbook (6) suggests, by means of a filter-funnel, rubber tubing, and a rather wide needle such as those supplied for the injection of salvarsan; or directly, in a more concentrated solution, out of a syringe, with a finer needle. Dilute solutions are recommended from fear of causing venous thrombosis by the use of those more concentrated, and on the whole they are less disturbing to the patient. For convenience, however, and everyday use, they are not to be compared to concentrated solutions given from a syringe. When a filter has to be used, there is more difficulty in sterilizing the apparatus, and if several cases are being done, one's progress is slow. With a syringe and a concentrated solution, fifteen to twenty patients can be treated in succession by the method to be described. The temporary discomfort caused to the patient by the strong solution may be disregarded, and there is no fear of causing thrombosis in any internal vein. All the materials required can be carried round from bed to bed on a small enamelled iron tray.

The syringe I have used is a twenty-cubic-centimetre Record syringe. This has the great advantage of taking the ordinary make of hypodermic needle as well as Record needles. The finest available needles should be used, because fine needles cause less pain, and because also large needles cannot be got into small veins. The large needle has nothing in its favour for this work. The syringe is best sterilized by placing for an hour in a glass jar containing five per cent lysol solution, with a little cotton-wool in the bottom. Glass jam-pots with screw-on tops are very suitable for this purpose. The syringe is in three pieces, barrel, piston, and a top-

piece to prevent lateral movement of the piston-rod. The top piece should be slipped over the piston-rod before being put into the lysol. Before use the syringe is washed out with sterile cool water, which can be carried in a tin with a loose cover. It is sufficient to dip the piston and metal top into the water, put the piston into the barrel and fix the top, and then to wash out the syringe with two lots of water drawn up, the first of these, at any rate, not being returned into the sterile water. It is inadvisable to boil Record syringes, and the above mode of sterilization is perfectly satisfactory. When a series of cases is being done, a tin of weak lysol solution should be carried round for washing out the syringe and needles after use. Some of this is first drawn up through the needle, then the needle is removed and the syringe washed out a couple of times, after which it is returned to the five per cent lysol. It is ready for use again by the time the hands are washed, and the vein chosen and the skin prepared for the next case. The needles are prepared for use by boiling in water with a little soda added. One needle should be put in for each patient, failing which there may be a little delay while needles are being re-sterilized. It is important to examine the points of the needles with a hand-lens each time before use, and to sharpen them on a stone if they are blunt. Long tapering points are undesirable. After being boiled the needles are picked out of the water with a pair of old dissecting-forceps, sterilized in the flame, and are put into one or more dry sterile test-tubes, plugged with wool. After the syringe has been filled with the quinine solution, the forceps are sterilized in the flame of a spirit-lamp, and a needle is picked out of the tube and fixed on the syringe.

The quinine solution I have generally used is a five per cent solution of the bihydrochloride, made up in distilled water, with 0·8 per cent of sodium chloride added. This is the most dilute solution of fifteen grains which a syringe can conveniently take. Syringes of forty cubic centimetre capacity can be had, but are awkward to manipulate. Single doses, each twenty cubic centimetres of a five per cent solution, may be put up in small glass bottles, plugged with sterile wool. The bottles themselves can be boiled before use in a saucepan. The quinine solution is boiled in a beaker, and twenty cubic centimetres are poured out into each bottle. The full bottles are then preferably re-sterilized in a steamer or autoclave, but if this is not available it is quite safe to steam them in a large covered saucepan. To fill the syringe from the bottle a long wide Record needle or cannula should be used, or failing this, a pipette made from glass tubing, and having attached to it a short connexion of rubber tubing holding a Record needle-head. If several injections are to be done, it is convenient to put the quinine solution up in a large bottle. One I have found useful is a wide-mouthed bottle of about 400 cubic centimetres capacity, fitted with a rubber cork pierced with two holes. One opening in the cork is for a short glass tube plugged with wool, which serves as an air-inlet. Through the other passes a long glass tube which reaches almost to the bottom of the bottle, and

which above the cork is curved through a semicircle. Rubber tubing is attached to the free end, and in the other end of the rubber tubing is fixed the head of a Record needle. In practice it is found advisable to support the rubber just above the needle-head by an inch of glass tubing placed inside. The rubber tube is closed with a clip. The syringe is fitted on the needle-head, and can be filled from the bottle in a few seconds. This bottle with its contents is best sterilized in the steamer. The quinine solution may be warmed up before use, but at any rate in the ordinary Mediterranean climate this is unnecessary, as the injection is made slowly.

Antimony for injection is made up as a 1 per cent or a 2 per cent solution of the tartrate in 0·85 per cent salt solution. This solution after sterilization can be conveniently put up in a bottle with a rubber cap, in the same way as a vaccine, and withdrawn by the usual method through the cap. Carbolic acid (0·3 per cent) may be added to keep the fluid sterile. The amount injected varies generally from 0·04 to 0·12 gramme of antimony tartrate. A ten-cubic-centimetres Record syringe can be used except for the larger doses of the one per cent solution.

Any prominent vein in the forearm may be chosen for the injection, but those at the bend of the elbow are the most suitable, being better anchored and generally bigger than the others. An application of tincture of iodine is sufficient sterilization for the skin. The vein is made prominent by the application of a band round the upper arm. If necessary the skin may be gently flicked, and the patient made to open and shut his hand a few times. When the vein is sufficiently prominent the movement of the patient's hand is stopped, and the needle pushed through the skin and into the lumen. To manipulate the syringe it is best to hold it between the middle phalanges of the fore and the middle fingers, with the needle towards the back of the hand. This position leaves the thumb free to push on the piston, and the other hand free to steady the skin. This can be done by laying the forefinger and the middle finger of left hand flat on the skin, one on each side of the vein, with the tips pointing upwards. After the needle is in the vein the left hand can be withdrawn without disturbing it. When the needle goes into the vein blood appears in the syringe, generally of itself, though sometimes it may be necessary to pull the piston gently. It is essential that this blood be seen, and if it does not appear then the needle is not in the vein. After blood appears no effort should be made to push the needle farther in. The injection is begun, and until it is completed the patient's arm and the point of the needle should be kept absolutely still. It is helpful to place the tip of the left forefinger on the skin over the position of the point of the needle, as faulty injection can be quickly detected by the swelling formed. The patient should feel no pain in the arm after the initial prick. If he does it is a sign that the liquid is being injected into the tissues. Should this occur the band must be re-applied, and the needle adjusted without withdrawal through the skin. It is essential to see blood enter the syringe again.

If it does not it is advisable to withdraw the needle and begin afresh. Generally one finds it best to push the needle first through the skin, at a very acute angle, and afterwards forwards and a little downwards in the line of the vein. The injection should take two to two and a half minutes. The little blood which has entered the syringe may be safely re-injected with the quinine or antimony solution. No dressing is required, but the patient should keep up a little pressure over the place of puncture for a few minutes to prevent bleeding under the skin.

The apparatus and materials required for the injection tray are as follows: Spirit-lamp, tincture of iodine, quinine solution, antimony solution, jar with syringe in five per cent lysol, covered tin of sterile water, tin of weak lysol for washing out syringe after use, tin containing dissecting forceps, brush for tincture of iodine, needles in test-tubes, and a little cotton-wool; and, lastly, a handkerchief or fine towel for compressing the arm.

During an intravenous injection of quinine the patient's sensations are unpleasant. About twenty seconds after it is begun, he experiences a feeling of uneasiness in the chest, and the respirations are deepened. This is followed by a sensation as of something rushing inside his head, and sometimes, as with an anæsthetic, there may be a feeling of warmth spreading over the body. If the patient has a sensitive taste, he may taste quinine in his saliva before the injection is completed—sometimes even in less than a minute. All these symptoms pass off within a few minutes. One finds them most complained of with the first dose. They are lessened when the injection is made as slowly as possible, and when the patient is well propped up in bed. I have never encountered a man who refused a second dose because of them. There should be no troublesome after-effects. Should one or two drops of quinine solution have been injected at the side of the vein during the process, there may be trivial swelling, which soon subsides. In a certain number of injections, about twenty per cent, thrombosis occurs in the vein for about an inch or an inch and a half above the point of puncture. The vein becomes a little tender for a day or two. It is not due to sepsis, and there is no fear of it spreading up the arm, and apparently no danger of a clot being dislodged. In fact, the most troublesome thing about it is that the vein is not available for further injections. The tendency to clotting varies much with different men. One may be able to put eight doses into the same vein of one patient, while in a few others thrombosis may occur in nearly every vein used.

There is a widespread opinion that the giving of quinine may precipitate an attack of blackwater fever in certain chronic cases of subtertian malaria. I have seen three cases which supported this view. All of them had been off quinine for some time before the attack of blackwater occurred, and in each quinine was given because of the beginning of a new malarial attack. With the first patient fifteen grains of quinine bihydrochloride was injected intravenously at 10 a.m. At 2 p.m. the patient felt out of sorts, his tem-

perature was 102° F., and he vomited. The urine he passed at 5 p.m. was of the colour of port wine, and contained much brown granular material. This was a comparatively mild attack, and hæmoglobinuria passed off within twenty-four hours of its being observed. The second case was similar. Four hours after a similar intravenous injection this patient had a rigor, and temperature of 102·4° F. The urine contained hæmoglobin for fifteen hours only. The patient's principal complaint during the attack was of pain in the back. He had had a similar attack of hæmoglobinuria in another hospital ten weeks previously after the administration of massive doses of quinine intramuscularly, and by the mouth. In the third instance [7] the attack came on a few hours after a dose of ten grains of quinine sulphate given by the mouth. This patient became very ill, indeed, but recovered. Apparently in these men the administration of quinine was the exciting cause of the hæmoglobinuria.

Cases of excessive susceptibility to quinine are met with, but true cases are uncommon. A comparatively common class, however, is that in which there is a gastro-intestinal susceptibility. The giving of quinine by the mouth causes vomiting, apart from the vomiting which may follow an oral dose at the height of a malarial attack. Patients of this class tolerate quinine as well as others when it is injected intravenously or intramuscularly. Much less common are cases in which there is a special susceptibility of the skin to quinine. The following is an example of a severe case of this sort. A patient was admitted to hospital with an attack of tertian malaria. For nearly a year he had taken quinine by the mouth, he said, but recently even a small dose had produced dermatitis. After six successive febrile attacks he consented to try the effect of a small intravenous injection of quinine. One grain of the bihydrochloride was given intravenously at 10.30 a.m. A scarlatiniform rash began to come out in the evening, and next day was well developed and very itchy. The skin of the forehead and face was red and thickened, and afterwards desquamated. The rash lasted for three days. This was probably an example, not of idiosyncrasy, but of excessive sensitiveness of the skin to irritants, because a similar acute dermatitis of the face occurred on other occasions, once after a short exposure to sunlight, and once after he had washed with carbolic soap. Another patient who was under observation at the same time may have been a real case of idiosyncrasy. He had never been able to take quinine, which had been tried in various forms. Two grains, he said, made him ill, and produced a scarlatiniform rash which was followed by desquamation. At the age of 14 he had gone to work with a manufacturing chemist, but had to give up the situation there because work he got to do with quinine, powder produced dermatitis and apparently also malaise. Obviously in cases such as these two the use of quinine as a remedy is out of the question. Slighter cases are occasionally met with in which after a dose there is transient erythema which can be disregarded. An example of such an intermediate case was a patient who could take two ten-grain injections on successive

days. This produced only a slight general erythematous rash, but further dosage aggravated this and caused so much discomfort that the patient was unwilling to have it.

The injection of antimony generally causes no inconvenience whatever to the patient, though there is sometimes irritative coughing for a few minutes* after the injection, and quite infrequently prompt vomiting, without nausea. I have not seen vomiting produced by a smaller dose than 0·07 gramme, but one patient always vomited with 0·08 gramme, or any larger dose. In strong contrast to quinine antimony hardly ever causes local thrombosis of the vein. If, however, any of the solution be injected into the cellular tissue, great irritation is set up, with swelling, tenderness. and congestion, and this condition may last for days. The fear of this is perhaps a reason for preferring a one to a two per cent solution of tartar emetic. I have met with two other phenomena of infrequent occurrence. One is that the patient experiences slight pains about the shoulders which commence some twelve hours after the injection and last for about twenty-four hours. They may be severe enough to disturb his sleep for a night, but thirty-six hours after the injection have usually gone. I have not found them except in patients having injections at intervals of three or four days, and then only after seven to nine doses. It is not connected with the place of puncture, because more often than not the pain seems to begin in the shoulder opposite to the arm which has been used. The pain is apparently in the muscles around the joint, and not in the joint itself. The other complication is probably due to the action of antimony, though the connexion has not been proved. This is an enlargement of the supra-cubital gland, which I have seen in three cases. The enlargement in these patients began two or three months after a course of five injections of antimony. The gland was firm and slightly tender, but showed no redness or tendency to suppurate or break down. In two cases the swelling subsided slowly, and had disappeared two months later. In the third case a second enlarged gland appeared two weeks after the first, three inches higher in the arm. This patient was lost sight of two months later whilst both glands were still enlarged. The condition is definitely not due to sepsis, or to the escape of antimony into the tissues at the site of injection, but its occurrence in these patients without apparent cause makes it probable that it was connected with the course of treatment.

Conclusions.

(1) Of 104 patients with chronic relapsing tertian malaria, who were treated in 1917 with intravenous injections—three of quinine bihydrochloride, and five of antimony tartrate—fifty-five per cent remained free from attack for three months or longer.

(2) A few cases treated similarly in the spring of 1918 gave much less favourable results.

(3) Intravenous injections of quinine will check any series of attacks, but have not much effect in preventing relapses.

(4) Intravenous injections of antimony tartrate gradually exercise a destructive influence on the parasite, and have an effect in preventing relapses.

(5) In cases of subtertian malaria the best treatment is by ntravenous injections of quinine.

(6) Intravenous injections of antimony tartrate have some effect in causing crescents to disappear from the blood.

(7) For injections in a number of cases in succession, solutions which can be given from a syringe are the most useful. Such are a five per cent solution of quinine bihydrochloride and a one per cent solution of antimony tartrate. There are no serious objections to the use of such a concentrated solution of quinine.

I am greatly indebted to Colonel Sir A. Garrod, A.M.S., for advice, criticism, and help in various ways; I have also to thank Captain L. R. Thomson, R.A.M.C., for his observation of nearly all tertian cases during the three months after treatment.

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AGGLUTINATION IN BACILLARY DYSENTERY.

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During the summer and autumn of 1916 many cases of dysentery, which proved to be bacillary, were admitted into Tigne Hospital, Malta, from Macedonia. All the cases were examined by the usual cultural methods, and an attempt made to isolate the infecting organisms. This was not at all difficult when the cases were in the acute stage, passing a great deal of blood and mucus. However, in the cases where the acute stage had passed, and the patients were already more or less convalescent, isolation of the infective organisms from the stools was far more difficult, and in a considerable percentage of such cases it failed altogether.

It was with the purpose of diagnosing these cases in which no isolation was effected that we undertook the present inquiry.

Technique.

The technique adopted was as follows :—

At first the strains used for making bacillary emulsions were those of the Lister Institute of Preventive Medicine obtained by the courtesy of Major Arkwright, R.A.M.C.

The organisms were grown for twenty-four hours on + 10 agar in Roux bottles and an emulsion made in 0·5 per cent carbol saline. The emulsions were filtered and standardized by comparing their opacity with that of a standard emulsion containing 2,000,000,000 per cubic centimetre. Before use each emulsion was tested against the homologous agglutinating serum issued by the Lister Institute. This testing was repeated from time to time, not only against specific but also against normal sera to detect those changes in agglutinability which occasionally occur. The patient's blood was collected in a Wright's tube—allowed to clot, centrifuged, and the clear serum measured in a graduated one-cubic-centimetre pipette and diluted with saline to the proportion of 1 : 40 (e.g., if serum measured 0·1 cubic centimetre, then 3·9 cubic centimetres saline added gave a 1 in 40 dilution).

For the test itself glass tubes two inches by $\frac{3}{8}$ inch were used which fitted loosely into holes bored in rows in flat wooden blocks, and sets of five of these tubes were put up for each test. By means of a pipette eight drops of a standard emulsion of the organism against which the serum was to be tested were put into each of the five tubes, followed by the necessary number of drops of saline solution and then of the diluted

serum, the pipette being washed in boiling saline and cooled between each addition.

The following table shows the application of the method:—

TABLE I.

No. of tube:	(1)	(2)	(3)	(4)	(5) Control tube
Emulsion (drops)	8	8	8	8	8
Saline (drops)	0	4	6	7	8
Diluted serum (drops)	8	4	2	1	0
Total	16	16	16	16	16

Thus the actual dilution of the serum in the first tube of the series is double the preliminary dilution—1 in 40 in our case. In the second tube the dilution is double that of the first and so on, the fifth tube being the control. By varying the initial dilution of the serum and by varying the number of drops it is possible to obtain any desired dilution. The tubes were incubated at 37° C. for four hours, and then allowed to stand overnight at room temperature. The results were read macroscopically and confirmed by means of a lens in daylight against a dark background. Only in the instances where all the bacteria were clumped, leaving the intervening fluid quite clear, were positive results recorded. No notice was taken of the incomplete clumping which left the medium still turbid.

Variation in the Agglutinability of Flexner Strains.

When the work had been going on for some time it was noticed that, whereas the agglutinability of the Shiga and Y strains remained constant, the Flexner strain became more and more easily agglutinated even by normal sera. This strain was therefore discarded as giving unreliable results, and two strains of Flexner, which had recently been isolated in the laboratory and which on testing were found to give good results, were used instead, together with another strain of Y (labelled Tigne). These two strains of Flexner differed in their agglutinability as can be seen from the following table showing the results of some of the preliminary tests made against the Lister Y sera.

TABLE II.

	First examination				Second examination				Third examination				Fourth examination			
	1 in 400	1 in 800	1 in 1,600	1 in 3,200	1 in 400	1 in 800	1 in 1,600	1 in 3,200	1 in 500	1 in 1,000	1 in 2,000	1 in 4,000	1 in 500	1 in 1,000	1 in 2,000	1 in 4,000
Strain B	+++	+++	++	±	+++	+++	++	+	+++	++	+	–	+++	+++	+	–
„ R	+++	+++	+	–	+++	+++	+	–	+++	+	–	–	+++	+	–	–
„ Y (Tigne)	+++	+++	++	–	+++	+++	++	±	+++	+++	–	–	+++	++	–	–

+++ = complete clumping.

It can be seen that the strain R is not as easily agglutinated as either of the others. This strain R was also agglutinated in a lesser degree as a rule by the sera of dysentery patients, but there were a few sera which agglutinated R more strongly than either B or Y (Tigne). Although the strain Y (Tigne) did not ferment maltose, serologically it behaved very much like the strain B which was in every way a typical Flexner.

This variation in the agglutinability of the different Flexner strains makes it important that a suitable strain should be selected for use, and further that the emulsions used should be thoroughly and periodically tested both against normal and specific sera in order to obtain reliable results.

Examination of Normal Sera.

The first step was to determine the lowest dilution at which agglutination could be regarded as specific, since the conclusions obtained by various workers differ widely on this point. No doubt these discrepancies are due to differences in technique and in the agglutinability of the strains used. The number of normal sera examined was seventy-two, obtained as follows: Thirty from patients in the civil hospital, none of whom had been inoculated against T. or T.A.B.; forty-two from convalescent soldiers, who had been inoculated against T.A.B., and who gave a negative history of dysentery. This number included seven Royal Army Medical Corps orderlies who had been employed in the dysentery wards for the previous twelve months.

The results obtained are shown in the accompanying table :—

TABLE III.

Strain	Dilution 1 in 40			Dilution 1 in 80			Dilution 1 in 160		
	Number examined	Number positive	Per cent	Number examined	Number positive	Per cent	Number examined	Number positive	Per cent
Shiga Lister..	40	14	35·0	70	8	11·4	70	0	0
Y Lister ..	30	8	26·6	70	8	11·4	70	1	—
Y (Tigne) ..	35	26	74·3	50	16	32·0	50	1	—
Flexner B ..	40	22	55·0	53	17	32·1	53	2	—
,, R ..	25	13	52·0	40	6	15·0	40	0	0

It can be observed that in no instance was Shiga agglutinated in a dilution of 1 in 160. Both strains of Y were agglutinated in this dilution—on one occasion by the serum of an enteric fever patient, which agglutinated in a dilution of 1 in 640. This patient's serum also agglutinated one strain of Flexner in the same dilution. This raises the question which we are investigating, whether enteric fever raises the titre towards dysenteric organisms. Flexner was agglutinated in a dilution of 1 in 160 in two instances, one being the enteric fever case mentioned above, the other

one of the orderlies, who worked in a dysentery block. We concluded from these results that as regards both Shiga and Y complete clumping at 1 in 80 dilution is suspicious of infection, whereas complete clumping in a dilution of 1 in 160 is to be regarded as specific.

With reference to Flexner no fixed limit can be given, since this varies according to the culture which is being used. For our strains a dilution of 1 in 160 was considered to be a safe starting point.

Examination of the Sera of Patients known to have Shiga Dysentery.

The next point to be investigated was the behaviour of the sera of dysentery patients towards their respective infecting organisms. One hundred and sixteen samples of sera obtained from patients, from whose stools *Bacillus Shiga* had been isolated, were examined. The results are shown in the accompanying table, where the cases are classified according to the duration of the disease:—

TABLE IV.

Duration of disease	Number examined	Positive 1 in 160 or over	Negative in 160
Less than 2 weeks	33	16	17
More than 2 ,, ...	83	75	8
,, 3 ,, ...	46	44	2
,, 4 ,, ...	30	30	0

NOTE.—The figures given for the "more than two weeks" group include the subsequent ones.

It can be seen from the tables that when a case of Shiga dysentery is examined after two weeks it is extremely probable that agglutinins in sufficient amounts to be diagnostic can be demonstrated, the number of cases in which a diagnosis could not be made by agglutination being very small.

Examination of the Sera of Patients known to have Flexner or Y Dysentery.

We have not had the opportunity of examining a large number of Flexner and Y cases. The bloods of seven cases, from whose stools Flexner was isolated, were examined. Three of these were between the second and third week, and of this number one was negative in a dilution of 1 in 80, one reacted to 1 in 160, and the third to 1 in 640. Two cases examined at the fourth and at the fifth week respectively agglutinated to 1 in 160, while the remaining cases, which were examined at frequent intervals between the first and fifth week, never showed any tendency to clump in a dilution higher than 1 in 80. Twelve cases of Y infection were examined:—

TABLE V.

Duration of disease	Number examined	Negative	Positive 1 in 80	Positive 1 in 160
Less than two weeks	5	2	3	—
During third week	2	—	1	1
After three weeks	3	2	1	—

The twelfth case was examined soon after onset, and subsequently at frequent intervals. The reaction, which was negative at the onset, was positive in 1 in 80 dilution after six days; a second examination made on the sixteenth day gave complete clumping at 1 in 160; a third examination after twenty-six days was incomplete at 1 in 160; the patient was then discharged from hospital. The actual attack of dysentery in this case had lasted only five days.

It can be seen from the results obtained that there are cases of Flexner or Y dysentery in which no evidence of the presence of agglutinins can be detected in the sera. It is to be noted that in all these negative cases the disease had run a very mild course. The following is a typical example:—

R., aged 38. Two days after admission into hospital had an attack of abdominal pain with diarrhœa and tenesmus. During twenty-four hours he passed twenty stools almost entirely composed of gelatinous mucus with a few streaks of blood. The Flexner bacillus was present in large numbers in the stool examined. The patient was treated in the usual manner with salines and on the second day the number of stools was sixteen and these contained a considerable amount of fæcal matter. On the third day there was one loose motion and on the fourth day the condition was normal. The agglutination in this case was negative throughout.

In the cases where the disease ran a more severe course, approaching that usually followed in Shiga cases, the agglutinins could as a rule be demonstrated.

Examination of the Sera of Dysentery Patients, the Causes of their Dysentery being undiagnosed.

Having established that the serum of dysentery patients, especially those infected with Shiga, agglutinated their respective infecting organisms, we began to examine the sera of clinical cases of dysentery in which examination of the stools had failed to determine the presence of pathogenic protozoa or *B. dysenteriæ*.

The number of such cases examined was 120. These we have divided into three groups.

The first group of fifty-five cases was tested against the Lister Institute

Shiga, Y and Flexner strains, during the time that the Flexner strain was not agglutinated by the serum of normal people in a dilution of 1 in 160.

The second group of forty-two was only tested against the Lister, Shiga and Y strain.

The third group of twenty-three was tested against the strains mentioned in Table III.

The results obtained are shown in the following table:—

TABLE VI.

Group	Total number sera examined	Positive		Titre stopping at: 1 in 80	1 in 160	1 in 320	1 in 640	1 in 1,280	Total
First ..	55	30	Shiga ..	4	6	7	5	1	23
			Flexner	—	4	1	0	0	6
			Y ..	1	0	0	0	0	1
Second ..	42	32	Shiga ..	6	8	7	2	0	23
			Flexner	—	—	—	—	—	—
			Y ..	4	4	1	0	0	9
Third ..	23	12	Shiga ..	0	1	4	0	1	6
			Flexner	0	3	1	1	0	5
			Y ..	0	1	0	0	0	1

This table shows:—

(1) That 120 cases were examined with seventy-four positive results.

(2) Forty-two reacted towards Shiga in a dilution of 1 in 160 or more; they are therefore regarded as undoubted cases of Shiga infection. Ten other cases which reacted in a dilution of 1 in 80 were probably also cases of Shiga infection.

(3) Five of the cases gave undoubted evidence and five more gave probable evidence of Y infection.

(4) That of the seventy-eight cases examined against Flexner ten were serologically cases of Flexner infection. It is probable that the thirty-six negative cases of the first and third groups included cases of Y and Flexner of the mild catarrhal type.

The comparison of the results obtained by agglutination alone with those arrived at by actual isolation of the infecting organisms is interesting. During four months of the epidemic we examined 236 patients, whose stools contained blood and mucus and got 142 (60 per cent) positive results, of which 110 (77 per cent) were *B. Shiga.*

The agglutination results in the above table show 74 (61 per cent) positive and of these 52 (70 per cent) were regarded as cases of Shiga.

It may be mentioned here that in two cases the diagnosis of Shiga infection made on the strength of the agglutination was subsequently confirmed by isolating the organism from the stools.

The following table gives the dilutions in which agglutination of Shiga

was obtained, the cases being classified according to the interval between the onset and the serological test. The table includes cases in which diagnosis was made by isolation of the organism as well as those diagnosed by agglutination.

TABLE VII.

Length of time after onset	Number examined	Negative	Positive				
			1 in 80	1 in 160	1 in 320	1 in 640	1 in 1,280
Less than 10 days.. ..	8	6	2	—	—	—	—
,, 2 weeks ..	30	7	8	6	6	3	—
2 to 3 weeks	38	1	5	9	13	6	4
3 ,, 4 ,, ...	21	0	2	6	10	0	2
4 ,, 6 ,, ...	26	0	0	9	10	7	1
6 ,, 8 ,, ...	17	0	0	8	4	5	0
8 ,, 10 ,, ...	18	0	0	2	7	7	2

This table shows the following :—

(1) That agglutinations are, as a rule, not present before the tenth day.

(2) That after the tenth day of the disease a rapid rise in titre takes place and in a comparatively short time a titre of 1 in 320 to 1 in 640 may be reached.

(3) That the decline takes place very slowly, agglutinations ten weeks after the onset being still well marked.

We carried out weekly examinations in a number of cases and the results obtained, which are embodied in the table, are in agreement with the conclusions stated above. One of these deserves special mention as it shows that a high titre may be reached at the height of the acute stage of the disease. This was the case of a boy, R. N., aged 8, who became ill on December 16; Shiga was isolated on December 27; the disease ran a very severe course with continuous pyrexia and the patient died on January 4, 1917. The serum taken from the heart at the post-mortem examination agglutinated Shiga 1 in 2,560, and Flexner and Y to 1 in 160.

The occasional occurrence of very high titres in Shiga cases leads us to believe that in some cases the blood-stream is invaded by the organisms. We have not systematically searched for *B. dysenteriæ* by blood culture, but positive cases have been recorded by other workers (Ledingham and Penfold, *British Medical Journal*, p. 704, 1915).

Group Reactions.

We noticed in many instances that infection by one of the dysentery organisms raised the agglutinating titre of the patient's serum towards the other known dysenteric organisms. This we noted more particularly in cases of Shiga infection, since it was with this type we mostly had to deal.

TABLE VIII—CO-AGGLUTINATION OF Y BACILLUS IN CASES OF SHIGA DYSENTERY.

Titre towards Shiga	No. of cases examined	Co-agglutination of Y bacillus			
		1 in 80	1 in 160	1 in 320	1 in 640
1 in 80	22	5	1	—	—
1 in 160	31	7	1	—	—
1 in 320	42	5	1	1	—
1 in 640	24	6	3	—	—
1 in 1,280	3	2	—	—	—
1 in 2,560	3	1	—	1	—

TABLE IX.—CO-AGGLUTINATION OF FLEXNER BACILLUS IN CASES OF SHIGA DYSENTERY.

Titre towards Shiga	No. of cases examined	Co-agglutination of Flexner bacillus			
		1 in 80	1 in 160	1 in 320	1 in 640
1 in 80	7	1	—	—	—
1 in 160	13	6	2	—	—
1 in 320	21	5	7	5	—
1 in 640	12	4	0	2	2
1 in 1,280	2	0	0	0	1
1 in 2,560	2	1	—	—	—

On comparing results shown in the above table with those given in Table III, Table III shows that 11·4 per cent of normal sera agglutinate Y in a dilution of 1 in 80, whereas this table shows twenty-six per cent of sera agglutinating Shiga also agglutinated Y in a dilution of 1 in 80 or higher, and this tendency becomes more marked with the rise of the titre towards Shiga.

The behaviour of sera agglutinating Shiga towards the Flexner group shows a more definite group reaction. Four per cent of normal sera agglutinate Flexner in a dilution of 1 in 160, which is increased to ninety per cent agglutinating in a dilution of 1 in 160 or higher in Shiga cases.

PARA AGGLUTINATION OF Y AND FLEXNER.

Here the connexion is closer. Most cases which agglutinated Flexner also agglutinated Y almost to the same degree and vice versa.

As previously mentioned the titre towards Flexner and Y seems to be raised not only in Shiga cases but in cases of typhoid and paratyphoid also.

In addition to the case referred to before, we have observed another case where Shiga followed paratyphoid infection. In this patient, quite early in the illness, while the titre towards Shiga was still 1 in 80 the titre towards Y was 1 in 160. There was no previous history of dysentery and the stools

had been repeatedly examined during the paratyphoid illness and no organisms of the dysenteric group found.

Joint Cases.

We also investigated the properties of the serum of cases stated to be suffering from dysenteric arthritis. The cases were not numerous, but they show that in arthritic complications a fairly high agglutinating titre is practically invariable, the range being 1 in 320 to 1 in 2,500. We would like to emphasize the importance of this from a diagnostic point of view, because it would seem that by agglutination we have a means of knowing whether a given case of arthritis is really of the post-dysenteric type. In our hands the test has given very good results in differentiating between dysenteric arthritis and rheumatic, gonococcal, traumatic, and other types of joint diseases.

An epitome of the clinical history of the cases follows :—

(1) Dunn. Dysentery: Onset September, 1916. Blood and mucus for two weeks; left ankle-joint, wrists and knee-joints affected. Agglutinated October 7, 1916: Shiga 1 in 320, Flexner negative, Y negative.

(2) Walker. Dysentery: Onset September 15, 1916. Passed blood and mucus. Right shoulder-joint affected October 15, 1916, when the patient was still passing mucus; then right elbow, left shoulder and both knee-joints affected. Agglutinated October 8, 1916: Shiga 1 in 640, Flexner negative, Y negative. January 30, 1917: Shiga 1 in 800, Flexner 1 in 80, Y 1 in 80. March 8, 1917: Shiga 1 in 320, Flexner 1 in 160, Y 1 in 160.

(3) Chadwick. Onset September 20, 1916. Right ankle affected November 11, 1916; left ankle, November 14, 1916; left metacarpal phalangeal joint also affected. Agglutinated November 7, 1916: Shiga 1 in 2,500, Flexner 1 in 400, Y 1 in 160.

(4) Buckledee. Onset September 26, 1916: Joints began to swell on October 1. Agglutinated November 6, 1916: Shiga 1 in 320, Flexner 1 in 160, Y negative.

(5) Baker. Indefinite history of dysentery: Both ankles painful and swollen. Agglutinated December 7, 1916: Shiga 1 in 320, Flexner 1 in 160, Y negative.

(6) Howell. Onset October 28, 1916. Right knee-joint affected December 1, 1916. Agglutinated December 9, 1916: Shiga 1 in 320, Flexner 1 in 160, Y negative.

(7) Dewfall. Onset October 19, 1916. Acute conditions two weeks; left knee-joint affected November 12, 1916. Agglutinated December 5, 1916: Shiga 1 in 640, Flexner 1 in 320, Y in 160.

(8) Norton. Onset December 4, 1916. Joints affected December 7, 1916: Agglutinated March 17, 1917: Shiga 1 in 320, Flexner negative, Y negative. April 12, 1917, with same result.

EYE CASES.

(1) O'Hallam. Onset beginning December, 1916. Dysentery lasted one week. Right eye affected: iritis, February 1, 1917. Agglutinated March 18, 1917 ; Shiga negative, Flexner 1 in 320, Y 1 in 160.

(2) Southgate. This patient had iritis. Agglutinated: Shiga 1 in 400, Flexner and Y negative.

(3) Onset November 26, 1917. Cyclitis. Agglutinated January 15, 1917: Shiga 1 in 320, Flexner 1 in 160, Y 1 in 80.

For the above eye cases we are indebted to the courtesy of Captain Keep, R.A.M.C.

CONCLUSIONS.

For the purpose of diagnosing cases of bacillary dysentery by means of agglutination we recommend the following procedure :—

(1) Strains of Shiga, Flexner and Y should be tested both against specific and against normal sera. The strains to be selected are those giving the most marked agglutination with the former, while giving the least marked with the latter. These strains should not be subcultured oftener than once a month, and should be further tested at intervals.

Emulsions should be prepared, standardized and tested in the way detailed previously.

A series of tests should then be made to determine the highest titre in which the organisms are agglutinated by normal sera.

Agglutination in double this determined titre can certainly be regarded as specific for the particular strain used.

(2) In an ordinary attack of Shiga a positive agglutination may be expected about the tenth day, and further tests should be made at the end of the second, and if necessary at the end of the third week in case there is a gradual rise in titre.

(3) In Flexner cases a serological diagnosis is not always possible. Frequently the attack only lasts a few days and from the cases we have seen we consider that infection by the Flexner organism does not give rise to as severe an attack of dysentery as Shiga or Y. We may mention that we have not had a death due to infection by this organism.

(4) An infection by Shiga raises the titre for the Flexner-Y type, etc.

(5) We have not found that the giving of curative sera has any effect on the specific agglutination titre (the titre of the curative sera (Lister) used at Tigne was 1 in 320 to Shiga).

(6) Failure to obtain agglutination when the disease is clinically of a mild type makes it probable that the infecting organism is of the Flexner or Y type. This probability becomes almost a certainty if the clinical picture and the character of the stools (presence of pus—absence of pathogenic protozoa) point to the case being one of bacillary dysentery.

On the other hand, failure to obtain agglutination after three weeks (except in clinically mild cases) is probably to be explained by the infecting organism being an atypical strain of dysentery bacillus.

(7) In the case of arthritis complications of dysentery agglutination is of a still further value. The joint complications from the clinical point of view are quite indistinguishable from other kind of metastatic arthritis caused by other organisms, and the mere fact of a patient having had dysentery does not preclude that he is not subject to other kinds of joint troubles. On a priori grounds the virus of dysentery must get to the joints via the blood-stream and that is the place where it is most likely to leave traces of itself in the shape of agglutinins. As a matter of fact agglutination in fairly high titre has been constant in our series of cases, which tends to support our view.

We regret that we were unable, owing to pressure of other work, to make a more complete investigation, which we should like to have done.

A more detailed examination of the serum in each case, with the inclusion of further tubes in each test, would have given more information.

One cannot help noticing that bacteriologists, as a rule, jump from a titre of 1 in 800 to 1 in 1,600 or from 1 in 1,600 to 1 in 3,200 in their agglutination tests with the same mathematical cheerfulness that they go from 1 in 50 to 1 in 100. This method of doubling the titre from tube to tube is not always the best technique, and very frequently fails to determine the end-point without further tests being made.

In conclusion, we wish to express our thanks to Captain Coleman, R.A.M.C., and Captain Todd, R.A.M.C., who gave us every facility in the collection of sera; to Lieutenant-Colonel Price, R.A.M.C., Officer Commanding Imtarfa Hospital; and to the medical staff there for permission to work at cases undergoing treatment in that hospital. Also we acknowledge our considerable obligation to Lieutenant-Colonel O'Sullivan, R.A.M.C., Director of Laboratories, Malta, for his advice and assistance throughout.

Since writing the above we have had a further opportunity of investigating similar cases and hope to issue the results obtained at an early date.

NOTES ON SOME HEAD WOUNDS—FROM A GENERAL HOSPITAL IN FRANCE.

By Captain F. W. WATKYN-THOMAS.
Royal Army Medical Corps.

The period covered by this paper was one year, from July, 1916, to July, 1917. Our patients usually arrived about thirty-six hours after being wounded. Most of the wounds were caused by fragments of shell and nearly all were infected. The methods adopted, therefore, differ from those that would be suitable in a more advanced area where the wounds are still fresh. The men seemed to stand the journey well, but if possible operation was postponed for twenty-four hours. It may be remarked here that the work of Allers [1] shows the danger of early transport of head cases after operation, not before.

These cases may be conveniently grouped as "Skull Wounds" where the dura is intact, and "Brain Wounds" where dura and brain are lacerated. No accurate statistics can be offered, for many of the worst cases never reach a base hospital and a few die in England [2], thus if the man mentioned in Case 4 had been evacuated at the usual time he would certainly have been included among the successes. It may be said, however, that none of the patients with skull wounds died, and of those who reached us with a diffuse meningitis already established none recovered—with one possible exception, *vide* Case 5. Of the other cases with brain wounds, the tangential injuries were the most satisfactory. "Through-and-through" wounds were rare. Only four such cases were admitted last year. Two of these recovered. Most of the patients with direct hits had not any metallic fragment in the brain. There was usually a small puncture in the outer table, with some fissuring, and extensive shattering of the inner table, with laceration of dura and brain by the splinters. In one case a piece of 5·9 shell about ⅜-inch square was firmly impacted in the skull. In another the casing of a bullet was jambed in the frontal sinus. There can be no doubt that many of these patients owed their lives to the shrapnel helmets. The most common cause of death in these cases was either a spreading meningitis from the wound, or a destructive softening of the brain opening into the lateral ventricle, as described by Mueller [3]. True abscess formation was not common. There were only two such cases in my last fifty.

For notes on these cases I used a special eight inches by five inches index card, printed for me by Messrs. Bowes and Bowes, Cambridge (fig. 1).

HEAD INJURY,	Tangenital	Dura torn
No.	direct	metal retained
	thro' thro	,, removed

Diagnosis

Complication ________________________ result ________

Particulars ________________________

Wounded __________ Admitted __________ Discharged __________

Concussed __________ on admission __________

Vomited ________________________

Wound ________________________

REFLEXES											PARALYSES, etc., C.S.F.
	L	R	L	R	L	R	L	R	L	R	
Pupil. lt											
acc...											
con...											
Abdominal											
Cremaster...........											
K J J..................											
Clonus											
Plantar...............											
Koenig											
Tache											
Astereo											

Fundus

Skiagram

Operation

The printed headings make tabulation and cross referencing very simple and fuller notes can be written on the back.

Examination and the Symptom Complex.—Skiagrams, although often giving invaluable positive information, cannot always be trusted to show fractures or even loose pieces of inner table. On the whole we thought that, in this region, two plates, of an antero-posterior and a lateral view, were more useful than stereograms. Changes in the fundus were not so common with skull wounds as with brain wounds. Most patients with a laceration of the brain showed changes varying from slight engorgement to double choked disk. One of the most pronounced cases of papillitis we saw was associated not with a brain injury but with a damaged ethmoid labyrinth [4]. Other changes in vision were rare but one patient with a

depressed fracture of the occipital bone and a subdural hæmorrhage showed a narrowing of the fields that seemed to exemplify well the conclusions of Colonel Lister and Colonel Holmes [5]. Unfortunately we had not a perimeter, so the estimate was too rough to be of any real value. The most constant neurological signs in these cases were a contralateral plantar extensor response and increased knee-jerks. Loss of the abdominal reflex on the injured side were fairly common. The cremasteric reflex was too uncertain to be reliable. Paralyses were rare, so also was vomiting. Headache was usually present and severe, but the site seemed to bear little relation to the lesion. Often, on the other hand, especially in cases of fracture, even extensive, with an intact dura, and of laceration of the frontal lobes, there was little headache and the reflexes were brisk at first, but otherwise normal. In these cases of frontal injury there was weakness of the facial muscles of the same side. I cannot offer any explanation for this. It was too lasting to be the effect of concussion. A transient homolateral facial weakness is not uncommon with injuries low down over the parietal and occipital regions. This is, probably, a pure concussion and is sometimes seen after a severe "knock-out" blow on the jaw.

In several cases patients with severe injuries, e.g., a through-and-through wound of the right frontal lobe; a large depressed fracture of the right parietal bone; a laceration of the left temporo-sphenoidal lobe were positive that they had never lost consciousness.

Operative Technique.—A preliminary injection of morphia and atropine, sometimes with hyoscine, was usually given and chloroform administered with a Junker's inhaler. Latterly warm ether, given with Shipway's apparatus, was used. The head was shaved all over, and, under the anæsthetic, scrubbed with ether soap and a nail brush, dried with methylated spirit, and painted with iodine. The wound was cleansed separately and protected with gauze during the scrubbing. Towels were fixed to the scalp by stitches. Hæmorrhage from the scalp was controlled by a tourniquet or, more often, by Makka's clamps. These were found very useful and in only one case could any ill-effects be attributed to their use. Here a small abscess formed at the site of insertion of one of the clamps. Scalp wounds were excised as a routine, and if no fracture were present closed with silkworm gut. In the rare cases where injury seemed confined to the outer table the damaged bone was removed by cutting a crown of this table only with a small trephine. If the inner table proved intact nothing more was done. In the year there were only four such cases.

All fractures with intact dura were exposed and cleaned, splinters, damaged bone and clot removed, and the wound closed with Carrel tubes under the flap. In certain cases of this type, e.g., in some of those complicated by subdural hæmorrhages, Colonel Gray [6] and other authorities have obtained most satisfactory results from incision of the dura. None of the patients in this series, however, showed the indications for this procedure. One man might well have benefited from such incision, but

here the scalp was so septic and lacerated that it would have been risky and the wound was too far forward to do a subtemporal decompression through a safe surface. The symptoms disappeared, although slowly, after free removal of bone and repeated lumbar punctures. In "Brain wounds" the rules laid down by Colonel Sargeant [7] were followed. If possible in order to secure a good blood supply for the fascio-aponeurotic flap it was so fashioned that the base was directly continuous with the main pedicle. For the largest gaps this was, unfortunately, often impossible. For drainage of the brain wound the metal tube was usually replaced by a tube of gauze, moulded over a rubber tube, impregnated with collodion, hardened by suspension in chloroform vapour, and perforated with small scissors, or better, with an eyelet punch. These tubes can be sterilized by boiling and are very light and smooth. I am indebted to Lieutenant-Colonel G. S. Williamson for this suggestion. As far as I know, this use of the tubes is new, although I believe they have been used by laboratory workers for some time. The removal of bone was always started from a small trephine hole near the wound. A Doyen's perforator and a burr are more rapid and quite as safe as a trephine. As far as possible the cutting forceps, working from the new opening, should only engage clean bone in the bite. Carrel tubes, two on each side, were slipped under the base of the flap at the lowest corners.

The most satisfactory results were obtained from operations done on the fourth or fifth day, but it must be remembered that these were the cases in which there were no signs of a spreading meningitis and no symptoms of acute urgency.

All compound fractures were explored as it is quite impossible to exclude the possibility of a far more extensive shattering of the inner table with laceration of the dura by the splinters.

The treatment of meningitis is most unsatisfactory. I have never seen a case recover from drainage of the cisterna magna by the posterior route (Haynes's operation). From operations on the cadaver it seems much easier to drain the cisterna magna from the side. The lateral sinus is exposed with a gouge and the dura incised just below and behind the bend of the sinus. A tube, flattened, perforated, and with a solid end, can be slipped along the floor of the posterior fossa. Callosal puncture would be of no value in most of these cases as the ventricles are rarely found to be distended post mortem.

So far the most promising results have been obtained by a method suggested to me by Captain C. E. West, the intrathecal injection of the patient's own serum. It would be premature to offer any definite opinion on the method, but the few rough experiments already carried out go to show that the serum of the patient is definitely bactericidal to the organisms in the cerebrospinal fluid.

The following cases present some points of interest:—

No 1. *A Case of Mixed Aphasia.*—Pte. W., wounded November 13,

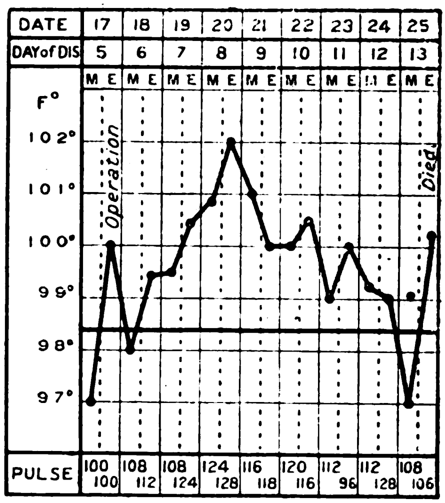
1916, admitted on November 16, 1916, with an extensive compound fracture of the left parietal bone over the angular gyrus and posterior limb of the sylvian fissure. He had been unconscious for two days, and when admitted was drowsy and irritable. He could say nothing but "yes," and "hullo," which he used quite freely and indiscriminately when disturbed. He seemed to recognize his name, and could understand simple orders—to turn round and so on. Pupil reflexes and eye movements were natural. Slight weakness of right facial muscles. Knee-jerks much increased and a double Babinski. No paralysis of limbs. Double choked disk, more marked on left. Pulse about 50. November 18, 1916: Wound explored. A long gutter fracture. A fragment of bone 1½ inches by ¾ inch removed from the lacerated brain, together with pieces of hair and some cloth, probably the lining of a shrapnel-helmet. Wound of the dura not enlarged. Drainage by collodion tube. The scalp was so torn that it was impossible adequately to close the gap. November 20, 1916: Fits starting in right shoulder, extending down arm and side, and unrelieved by lumbar puncture. Tense dura incised and wound left open. No further fits. November 22, 1916: He could recognize matches, soap, etc.; and showed how to use them but could not always name them. He also made attempts to spell his own name and got as far as the second letter. He was able to say "no" when asked by another patient if he was anxious to return to the trenches. December 1, 1916: He was found sitting up in bed studying his pay-book to find how much back-pay was due to him. His disks were then normal. No hernia developed in spite of the large loss of substance. This was one of the very few cases in which the dura opening was enlarged, and here it was done freely to relieve pressure. This man was returned to England convalescent, and when he last wrote, in March, 1917, had been invalided out of the Army and was back at his ordinary work as an iron-moulder. His letter was perfectly clear, well written, and well, although quaintly, expressed.

No. 2. *A Case of Cerebellar Laceration.*—This case is remarkable as it is rare for men with such injuries to live more than a few hours. This is the only case of the sort admitted to the hospital in a year.

Pte. C., wounded January 27, 1917, admitted January 29, 1917. He had been unconscious for about twenty minutes but had walked back to the advanced dressing station. When admitted, he was dull and stupid and complained of most intense headache. The only visible wound was a small puncture on the right through the origin of the trapezius. He was also suffering from acute enteritis and was passing blood and mucus. He was too exhausted for any immediate operation. Reflexes were normal except for rather exaggerated knee-jerks. There was a little facial weakness on the right. Disks engorged but not swollen. At no time was any inco-ordination, nystagmus, or dysdiadokokinesia observed. A skiagram on the 31st did not show any foreign body. Operation on 31st. An inverted J incision with the short arm on the ligamentum nuchæ was made. This

proved a mistake. It would have been better to have made the classical anchor incision. As it was there was an unnecessary amount of bleeding. A small puncture, too small to admit the tip of the little finger, was found in the occipital bone below the superior curved line. This was freely enlarged and a hole in the dura was found with a large flake of bone wedged in it. The splinter was removed and was followed by a gush of blood-clot, pulped cerebellar tissue, and more splinters. The wound was cautiously explored with a finger and a cavity found into which a collodion tube was inserted. On lumbar puncture the cerebrospinal fluid was blood-stained and under high pressure. Next day the headache had quite gone and there was no recurrence. The patient went to England quite well, and without any hernia on February 27, 1917. Although a large part of the right lobe had come away as pulp, he seemed to suffer no ill effects. It is true that they might become apparent when he started to get about. The facial weakness referred to cleared up in a few days.

No. 3. This case was interesting as it showed such a complete absence of many of the classical signs :—



Pte. S., wounded March 12, 1917, admitted March 17, 1917. There was a wound over the right temple which had, apparently, been excised and closed with a stitch. Both tibiæ were badly shattered. The patient seemed very stupid and irritable. Temperature 97° F., pulse 100. He could move his arms. His legs were on splints. It was impossible to examine the disks owing to his resistance. There was definite weakness of the right facial muscles. The wound of the head was explored. It was suppurating, and under it was a very small puncture not more than ¼ inch

across with two or three radiate cracks. When the bone had been removed a laceration of the dura was found, with extensive shattering of the inner table. The brain was explored and an abscess containing half an ounce of foul pus and several splinters of bone was drained. The patient died a week later. The only prominent sign he showed until the day before his death when he became comatose, was the use of startlingly obscene language on the least provocation. Apart from the face there was no paralysis. He never had a rigor, and the evening temperature was about 100° F., with a pulse of 100 to 120. Post mortem it was found that the abscess had burst into the lateral ventricle. The longitudinal sinus was full of pus and the right lateral sinus which opened into it was also filled with infected clot. In view of this the temperature chart is rather unusual.

No. 4. Pte. P., wounded February 17, 1917, admitted February 19, 1917: Came down as a walking case. A small puncture $\frac{1}{3}$ inch across above the right eyebrow, covered by a scab. No headache, no history of concussion or vomiting. Pulse and temperature normal. I was asked to see him on the evening of the 22nd, and he was complaining of headache and his temperature had risen to 101° F., pulse 108. There was a right facial weakness but no other paresis. The reflexes were brisk, but otherwise natural. No changes in fundus. When the scab over the puncture was removed, a perforation in the bone could be felt with the tip of the finger. A flap was turned down, and the dura was exposed. A small puncture was found. The wound was cleaned and drained without enlarging the dural opening. Next day his temperature fell to normal. He went on perfectly well, except for occasional slight headaches, but showed signs of mental instability—outbursts of temper over trifles, etc. At the end of three weeks he was marked for evacuation to England, but was delayed. On March 18, 1917, temperature rose again and he complained of violent headache. A skiagram taken some time before showed the fragment of shell in the neck at the level of the third cervical vertebra. Cerebrospinal fluid under pressure. Reflexes brisk, but otherwise natural as before. Left disk a little engorged. A small abscess in the frontal lobe was found and drained. All went well until March 29, when he again complained of headache. Vomiting, cerebral in type, commenced. Knee-jerk lost on right, increased on left. Left Babinski response. Cerebrospinal fluid under strong pressure, turbid, but sterile. A large abscess was found around a small spicule of bone. He died on April 4. Post mortem, it was found that the entire right lobe had sloughed away, and a fistula opened into the ventricle. The fragment of shell had entered through the frontal bone above the level of the sinus, and had escaped through the floor of the anterior fossa into the neck.

No. 5. Pte. G., a German prisoner, wounded April 8, 1917, admitted April 13, 1917. Entry wound behind base of right mastoid. Exit through left orbit. The left eye had been removed before he reached us. He was drowsy, with acute headache at intervals. There was com-

plete paralysis of the right facial. Partial of left hypoglossal. Motor fifth intact both sides. Movements of right eye natural except for a slight nystagmus with forced movements inwards on looking to the left. There was almost complete paralysis of left arm and leg. Knee-jerks increased on right. Doubtful left. The left abdominal reflex was lost. There was double Babinski. Right auditory meatus filled with blood. Cerebrospinal fluid under pressure, turbid, and contained pneumococci which did not grow in culture. The wound of entry was enlarged. Three large splinters of bone were removed from the right lateral sinus, each being followed by a gush of blood. Two holes were successfully patched with fascia, but the last defied such treatment and the sinus was packed. The petrous was badly shattered and large pieces were removed, the torn dura being cleaned as well as possible. It seemed that the patient had no chance, but next day he was a little better. On the 18th he had a succession of short fits, starting, apparently in the left masseter. Lumbar puncture proved that the cerebrospinal fluid was clearer, so that nothing was done, except to open the wound freely and remove a little more bone. Next day he moved his leg (left) a little. On May 8, he celebrated a visit from Colonel Bruce, our consultant, by lifting the paralysed arm. When sent to England a few days later, he could walk a little and learned a few words of the Anglo-Franco-Hundustani patois our men call French. It is hard to say why he recovered.

In conclusion, I should like to express my thanks to Captain R. L. Scott, the officer in charge of the surgical division, for his invaluable assistance and advice, to Captain Iles, our radiographer, and to our long-suffering anæsthetists, Captain Billing and Captain Talbot.

Note.—Since this paper was written a far more complete and efficient method of excising the bony injury in one piece has been described by Professor Cushing.

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THE DISCOVERY OF A SPECIFIC COMPLEMENT FIXATION TEST FOR BILHARZIASIS AND ITS PRACTICAL APPLICATION TO CLINICAL MEDICINE.

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CONTENTS.

I.—Introduction.

A careful study of the pathological effects of the parasitic metazoa, very especially of bilharzia, on the tissues of the host, as well as the ensuing local inflammatory reaction and the cellular-humoral response, inevitably leads to the conclusion (not at present fully appreciated) that these animal parasites and their ova exert their deleterious influence, not so much by their mechanical irritation, as by the secretion or excretion of some soluble toxin.

In this respect, as in many others, the parasitic metazoa resemble protozoal and bacterial invaders. A cellular-humoral response on the part of the host is common to all three groups of parasites. In bacterial infections polymorphonuclear leucocytes and mononuclear leucocytes are especially produced in excess. The polymorphonuclear leucocytes respond to the chemiotactic influence exerted by the toxins of the pyogenic group of bacteria, and according to Opie (1) they contain a leucoprotease ferment acting in acid or neutral medium: in such a leucocytosis an excess of neutrophile myelocytes can be seen in the bone marrow. The lymphocytes are produced in excess in typhoid and tubercular infections and they

contain a lympho-protease ferment acting in a medium which is slightly acid.

In protozoal infections, malaria, trypanosomiasis, Leishmaniasis, etc., there is an excess of large mononuclear cells in the peripheral blood which probably originate in the endothelial and pulp cells of the spleen.

Metazoal infections generally create a response of eosinophile cells. Eosinophile myelocytes increase in the bone marrow, as may be seen in monkeys experimentally infected with bilharziasis; in consequence differential and total counts show an eosinophile leucocytosis in the peripheral blood.

Similarly recent serological investigations revealed that an identical humoral response for all groups of parasites—bacterial, protozoal and metazoal—exists. In a number of *bacterial* infections antibodies of the nature of opsonin, agglutinins, and bacteriolysins may be demonstrated.

In *protozoal infections*, specific complement fixation reactions have been described. Noguchi [2] demonstrated both antibody and agglutinin in the sera of syphilitics by using a *specific* antigen made from cultured *Treponemata pallida*. McGowan [3] demonstrated positive complement fixation reactions in the sera of sheep infected with sarcosporidia; more recently Thomson [4] has reported a positive complete fixation in malaria.

Serological investigations in *helminthic infections* have similarly not been unfruitful.

In *cestode* infections positive complement fixation tests have been described for the *Tænia echinococcus* by Guedini [5], Weinberg and Parvu [6], Kreuter [7], and by Meyer [8] for *T. saginata*.

Fleig and Lisbonne [9], and later Welch and Chapman [10], described the precipitin reaction in hydatid disease, and Langer [11] and Le Dantec failed to demonstrate this phenomenon in other tænia infections.

In *nematode* infections Strobel showed that positive complement fixation reactions were given by the sera of patients infected with *Trichinella spiralis*.

In the *trematode* infections no such reaction has been so far described, but in the following pages I wish to report the discovery of a specific complement fixation reaction in bilharziasis.

II.—Factors leading up to the Present Investigation.

The frequency with which Lawton, and later the writer, noted urticaria, fever, and other symptoms, in the early stages of bilharziasis amongst Australian troops, strongly suggested the presence of some toxin, the product of the maturing or of the adult worms. Seeing that the initial symptoms subsided after a variable period and that the patient completely recovered until the signs and symptoms of localized bilharziasis supervened, it seemed to be probable on *a priori* grounds that recovery should be accompanied by the formation of some specific immune body in the blood.

A specific antigen was prepared from the livers of infected snails of the

species *Planorbis boissyi*, the intermediate host of *Bilharzia mansoni*, and, by employing the method of fixation of complement first described by Bordet and Gengou, antibody was demonstrated in the sera of patients infected with either *B. mansoni* or *B. hæmatobia*.

In June, 1917, this discovery was reported to the military authorities and since then I have very extensively utilized the method of diagnosis of bilharziasis in Australian, British and Egyptian hospitals with most gratifying results.

III.—Observations on Technique.

Antigens.—Two different antigens were utilized during the investigation, one a saline extract, the other an alcoholic one. In the great majority of cases the antigens were prepared from the infected livers of snails of the species *P. boissyi* (intermediary host of *B. mansoni*). Equally satisfactory antigens were also made from infected snails of the species *Bullinus dybowski* (*B. hæmatobia*).

Antigens prepared from either species of snails yielded positive completement fixation reactions for both kinds of infection in man (*B. hæmatobia* or *B. mansoni*), showing how closely biologically allied are these two species. The preparation of these antigens was as follows :—

(*a*) *Saline Extract*.—A number of infected livers were macerated in a solution composed of 0·85 per cent saline and 0·5 per cent phenol (one liver to one cubic centimetre solution). This mixture was shaken thoroughly on an electric shaker for twenty minutes and incubated for twenty-four hours at 37° C., to permit of extraction.

It was then filtered and the fresh filtrate used as antigen.

(*b*) *Alcoholic Extract*.—This was found to be the most satisfactory antigen. A number of infected snails' livers were macerated in a quantity of absolute alcohol, shaken thoroughly on an electric shaker, extracted for twenty-four hours at 37° C. and filtered. The filtrate was evaporated to dryness at 45° C. by means of a Sprengles exhaust pump. The residue was dried, weighed, and shaken vigorously into solution with 0·85 per cent saline and 0·5 per cent phenol (0·05 gramme of residue to twenty cubic centimetres solution).

The anti-complementary dose was then accurately estimated and *not more than one-third of this amount used in the test.*

The antigen was tested also for any hæmolytic tendency. Lately, as an alternative, I have adopted the simpler procedure of diluting the concentrated alcoholic extract with saline (0·85 per cent) and not actually evaporating it to dryness. The results of this modification have so far been satisfactory. Fresh alcoholic extracts should be employed as a routine as they are more sensitive than extracts kept in the ice-chest for several months.

A fresh suspension of three per cent *sheep's corpuscles* was always made. The blood was obtained from a sheep especially kept for the purpose, and

after citration (two per cent sodium citrate in saline) the corpuscles were repeatedly washed with saline and centrifugalized. The corpuscular suspension was sensitized by adding four M.H.D.s of hæmolytic serum and incubating at 37° C. for one half hour. This mixture was then kept at 8° C. till required.

The *blood* was obtained from the patient within *twenty-four* hours of performing the test and stored in the ice-chest till required. The resulting serum was diluted with four volumes of saline and heated to 55° C. for twenty minutes to destroy complement and any thermolabile anti-complementary body present in the serum. Any serum exhibiting anti-complementary tendency in the control tubes, or any serum in which microbic infection was suspected, was retested at a later date.

The *rabbit hæmolytic serum* employed was prepared in this laboratory by the intravenous injection of well-washed citrated sheep's corpuscles. The titre of the serum used was never less than 1 in 2,000.

Complement was obtained from a healthy guinea-pig the serum of which had stood in contact with the clot in the ice-chest for six hours before use. The M.H.D. of complement was always accurately determined.

Arrangement of the System for the Test.

The technique I have been latterly adopting is as follows:—

Small volumes of the reagents are measured by Donald's dropping pipettes. The total volume in the final stage of the reaction is 0·5 cubic centimetre (five volumes), and each unit volume equals 0·1 cubic centimetre. Racks containing four rows of tubes are utilized and the system is put up in the following order:—

(1) The first row contains one volume each of antigen, serum and saline, and one volume diluted so as to contain three M.H.D.s of complement.

(2) The second row contains similar volumes of the above reagents, except that the volume of complement used contains five M.H.D.s

(3) The third row contains similar volumes of the reagents but the volume of complement used contains seven M.H.D.s.

(4) The fourth row contains only serum, saline and complement (three M.H.D.s) and serves to detect the presence of any anti-complementary tendency in the serum under examination.

Two antigen controls, one containing one volume and the other two volumes of antigen are included, and also a pooled negative and a pooled positive serum.

This system is incubated for one hour at 37° C., and then one volume of sensitized sheep's corpuscles is added. The racks are repeatedly shaken, and readings registered at fifteen minutes interval. Final readings are made at the end of one hour.

Results are recorded as P +, P + +, P + + +, according as there is complete inhibition of hæmolysis in the tubes of the first row only, of the first and second only, or of the first, second and third.

P ++ and P +++ are regarded as definitely positive; P + on the other hand only as positive in the presence of signs and symptoms suggestive of the disease.

Quantitative estimations of the amount of complement fixed show that an average pooled positive serum, collected from cases of early bilharziasis, fix seven M.H.D.s of complement over and above that fixed by the average pooled negative serum. In more chronic cases, the excess fixation amounts to four M.H.D.s of complement.

IV.—Concerning the Specificity of this Complement Fixation Reaction.

(1) Examination of a microscopic section of an infected snail's liver shows it to be composed mainly of sporocysts and cercariæ distending the inter-acinous spaces and causing atrophy of the parenchyma. It follows that any extract of such an organ is largely obtained from these sporocysts and cercariæ and not from the liver cells.

(2) Antigens prepared from *normal* livers of snails (*P. boissyi*) show no tendency whatever to fix more complement with bilharzial than with normal sera.

(3) Antigens prepared from the livers of snails of the species *B. dybowski* infected with an allied cercaria (*Gastrodiscus aegyptus*) showed *no* increased tendency to fix complement with bilharzia sera.

(4) Prolonged investigation has failed to demonstrate any constant tendency to pseudo-positive reaction in any one disease or group of diseases, either in bacterial, metazoal, or protozoal infections. The sera of the following variety of helminthic infections, *T. echinococcus*, *Ascaris lumbricoides*, and *Ankylostoma duodenale*—have uniformly yielded negative results.

In the protozoal diseases, the sera of syphilitics, of relapsing fever, cutaneous Leishmaniasis and malaria, have all constantly yielded negative results.

In view of these observed facts, I regard this complement fixation test as a true Bordet-Gengou reaction; that is, it is dependent on an excess fixation of complement by a *specific immune body* contained in the sera of bilharzia patients in the presence of its specific cercarial antigen.

V.—Analysis of Results obtained in the Examination of Sera of 311 Hospital Patients using the Saline Extract of Antigen.

(*a*) In a group of cases, whose disease was of not more than two years' duration, thirty-nine out of fifty-four, or seventy-two per cent, yielded positive reactions.

(*b*) In another group of cases of more than two years' duration, thirty-one out of forty-six, or 67·4 per cent, yielded positive reactions.

(*c*) Thirty-five cases of syphilis yielded negative reactions utilizing freshly prepared antigen ; all gave strongly positive Wassermann reactions.

(*d*) One hundred and seventy cases suffering from different infections, bacterial, protozoal and metazoal, were all negative.

(*e*) In 12 cases a tendency to pseudo-positive reaction was observed: 6 cases yielded a P + ; 4 cases yielded a P + + ; 2 cases yielded a P + + +.

These sera were examined early in the course of the investigation. I am now aware that the use of *fresh* antigen and its more accurate standardization would certainly have eliminated this tendency in certain cases, but, as the alcoholic antigen was soon after found to be more sensitive and more stable than the saline variety, the former is now always used.

VI.—Analysis of the Results obtained in an Examination of the Sera of 322 Cases, using the Alcoholic Extract as Antigen.

In 322 consecutive cases investigated, the following results were obtained :—

(*a*) In a group of 36 cases of less than two years' duration, 32, or 88·8 per cent, yielded positive reactions.

(*b*) In a group of 97 chronic cases (of two years' duration and over), 72, or 74·2 per cent, yielded positive results.

(*c*) In forty-four cases of syphilis negative results were registered, though all gave positive Wassermann reactions. In one case a P + reaction was obtained, but this was due to anti-complementary tendency in the serum control tube.

(*d*) *In 150 other sera, which included protozoal, metazoal and bacterial infections, negative results were uniformly obtained.* In only one case was a positive result registered in which ova were not found in the dejecta, but, as only one microscopic examination was made, and a history of bathing in an infected locality was obtained, and as, moreover, certain intestinal symptoms were present, bilharziasis could not be excluded. Probably the case was one of *latent* infection.

VII.—The Immunity Response in Experimentally Infected Monkeys.

In monkeys (*Cercopithecus*), at a variable time after heavy infection with cercariæ, some or all of the following symptoms develop: Emaciation, anorexia, muscular weakness, tremor and definite rigors. If the monkey is going to die, these increase in intensity ; if recovery is to ensue, they diminish. Following recovery, localizing symptoms supervene at a later date. In *B. mansoni* infections dysenteric symptoms not uncommonly appear during the seventh to tenth week ; in infection with *B. hæmatobia* vesical ones were noted from the tenth to the twelfth. Not infrequently a severe secondary anæmia is present in these heavy infections. Poikilocytosis, anisocytosis, polychromatophilia and normoblasts may be observed

in blood smears; occasionally megaloblasts may appear. Both the hæmoglobin and the red blood corpuscular content of the blood are markedly diminished.

(a) *Observations on Blood Picture, etc., in Monkeys spontaneously recovering from the Disease.*

An analysis of Table I shows that in ten monkeys recovering from initial toxic effects of a massive cercarial infection, a remarkable cellular-humoral response was present in every case. The leucocytosis during the fifth to the twelfth week varied from 13,000 to 34,000 per cubic millimetre. The eosinophilia varied from 10 per cent to 63·2 per cent and the average over this period equalled 28 per cent. In every case a strongly positive complement fixation reaction developed. The bone marrow showed a marked increase in *eosinophile myelocytes*, great cellular proliferation and increase in the normoblastic elements.

TABLE I.—"THE CELLULAR-HUMORAL RESPONSE IN MONKEYS *recovering* FROM BILHARZIASIS."

No.	Species of infection	Time of observation	Complement fixation test	Eosinophiles*	Leucocytes per c.mm.	Autopsy
1	*B. mansoni* ..	11th week	Positive ..	22·2 per cent	15,000	Lateral - spined ova and worms
2	,, ..	5th ,,	,, ..	21·6 ,,	13,000	,, ,,
3	,, ..	7th ,,	,, ..	10·7 ,,	17,500	,, ,,
4	,, ..	8th ,,	,, ..	63·2 ,,	28,000	,, ,,
5	,, ..	7th ,,	,, ..	24·0 ,,	14,700	,, ,,
6	,, ..	8th ,,	,, ..	41·4 ,,	34,400	,, ,,
7	,, ..	6th ,,	,, ..	35·0 ,,	27,000	,, ,,
8	,, ..	12th ,,	,, ..	30·8 ,,	—	,, ,,
9	,, ..	12th ,,	,, ..	15·5 ,,	13,800	,, ,,
10	*B. hæmatobia*..	9th ,,	,, ..	16·6 ,,	18,000	Terminal-spined ova and worms

* In the Grivet monkey, the homologue of the eosinophile in man is a larger cell than the polymorphonuclear leucocyte and contains larger oxyphile granules. Its protoplasm however has a greater affinity for basic stain, and therefore, in staining by Leishman's method it is necessary to wash out longer than usual with distilled water to demonstrate the oxyphile granules.

(b) *Observations on the Blood Picture of Monkeys dying early in the Disease.*

While alive, the toxic stigmata in these monkeys are obvious and the symptoms I have enumerated pronounced. Microscopic examination shows cloudy swelling of the parenchyma of organs and peripheral infiltration of the liver with round cells. The cellular-humoral response is minimal as a general rule. The animals die either before there is time for an immunity response to develop, or, if they survive longer, the intensity of the toxæmia often causes a complete depression of the mechanism of

immunization as is seen in Table II. It is interesting to note that several of these monkeys died before ova could be deposited in their tissues, and as a direct result of the action of a circulating toxin, the product of the developing worms.

TABLE II.—"THE CELLULAR-HUMORAL RESPONSE IN MONKEYS *dying* FROM BILHARZIASIS."

No.	Species of infection	Time of observation	Complement fixation test	Eosinophiles	Leucocytes per c.mm.	Autopsy
11	*B. mansoni* ..	9th week	Negative ..	0·0 per cent	1,250	Lateral - spined ova and worms
12	,, ..	8th ,,	,, ..	11·9 ,,	8,800	,, ,,
13	,, ..	6th ,,	,, ..	18·0 ,,	18,000	,, ,,
14*	,, ..	7th ,,	Positive ..	50·2 ,,	25,000	,, ,,
15	,, ..	8th ,,	,, ..	11·0 ,,	6,000	,, ,,
16	*B. hæmatobia* ..	3rd ,,	Negative ..	0·6 ,,	2,200	..
17	,, ..	5th ,,	,, ..	..	2,200	..
18	,, ..	2nd ,,	,, ..	0·3 ,,	3,000	..

* This monkey (No. 14) developed severe bilharzial dysentery and ultimately succumbed.

VIII.—RELATIONSHIP BETWEEN THE GRADE OF EOSINOPHILIA AND THE COMPLEMENT FIXATION REACTION IN MAN.

In fifty cases of bilharziasis, combined observations were made on the eosinophilia and the complement fixation reaction, with the object of determining whether any relationship existed between the degree of cellular reaction and the humoral response to parasitic invasion.

The observations may be recorded as follows :—

(1) In twenty-three cases of bilharzia yielding a percentage of eosinphiles of from 1 per cent to 10 per cent, sixteen (or 69·5 per cent) yielded positive complement fixation reactions. The intensity of these reactions in this group, however, were not as great as in groups (2) and (3).

(2) In twenty-two cases the eosinophile count was between 10 per cent and 25 per cent; eighteen (or 86·7 per cent) yielded strong positive complement fixation reactions.

(3) In six cases in which the eosinophile count was between 25 per cent and 40 per cent all (or 100 per cent) yielded strong positive reactions. From these observations it will be seen that the higher the grade of eosinphilia present, the greater is the fixation of the complement. Positive fixation reactions are not uncommonly obtained in bilharziasis without any eosinophilia being demonstrated.

IX.—THE PRACTICAL VALUE OF THIS COMPLEMENT FIXATION TEST.

This reaction has a twofold application :—

(*a*) As a means of diagnosis.

(*b*) As a *therapeutic index* to the possible effect of any given drug on the parent bilharzia worm.

(a) As a means of Diagnosis.

In early bilharziasis, that is, prior to the onset of localizing lesions in the bladder and rectum, this is the only real method of diagnosis. In later cases where the localizing symptoms are obscure and ova are difficult to demonstrate (especially in *B. mansoni*), I have repeatedly diagnosed bilharziasis by the serological test alone; subsequent confirmation has been obtained by cystoscopic examination and later by the demonstration of ova in the dejecta after repeated examination. In establishing an endemic index for bilharziasis, this reaction is more applicable for the examination of a large number of people than is the more tedious microscopic examination of the dejecta. For the average case, however, the establishment of a diagnosis by the demonstration of ova in the dejecta must always remain the routine laboratory method, provided always its shortcomings, i.e., the necessity of repeated examinations, are recognized. The diagnostic value of this complement fixation reaction can perhaps best be shown by reports on the following groups of cases.

Report (a).—For three months cases presenting urinary symptoms such as hæmaturia, pain and frequency, were sent to me for examination frcm a number of British military hospitals in Cairo. In only three cases was I supplied with any previous information as to the presence or otherwise of ova in the dejecta. In sixteen a positive diagnosis was made on the blood findings alone; fifteen were reported as negative. In eleven of these negative cases, the cause of the urinary symptoms was traced to conditions, such as nephritis, renal calculus, etc. In the four remaining ones ova were being passed in the urine, while at the same time the serum reaction was negative. In three out of the sixteen cases which yielded a positive reaction, ova had not been found in the urine, but Colonel Wade, D.S.O., A.M.S., Consulting Surgeon, confirmed the serological diagnosis by cystoscopy and subsequently ova were demonstrated in each case. Thus out of twenty cases of bilharziasis (*B. hæmatobia* or *B. mansoni*), sixteen or eighty per cent were positively diagnosed by this method. No pseudo-positive reactions were recorded.

Report (b).—I was requested by the D.D.M.S., A.I.F., to investigate by means of this reaction an outbreak of bilharziasis in Palestine amongst the Mounted Yeomanry Divisions. These men had bathed, during the previous summer, in fresh water canals in the Fayoum where *Bullinus* snails exist in large numbers.

Systematic urinary examinations of the whole unit had been made, six weeks previous to my visit, and all cases passing ova, with the exception of six mild infections, were evacuated to the base. The complement fixation reaction was performed in the Anzac Field Laboratory some ten to fifteen miles behind the firing line. In all, fifty-six cases were examined; fifty of these were not passing ova in the urine and were apparently quite healthy men; in six ova were being passed. Out of the six cases in whom ova had

been demonstrated in the urine five yielded positive serological reactions. Of the remaining 50 cases, 8 gave positive reactions, and, within the next fortnight ova were found in the urine of 5 of them. Unfortunately, I was not able, owing to military exigencies, to follow up the remaining three cases over a longer period, but in two at least the blood picture showed an eosinophilia. Undoubtedly in all ova would have been demonstrated, had repeated examinations been possible.

Report (*c*).—Thirty-three cases of urinary and intestinal bilharziasis were examined, from the Asylum of the Insane, Abbassia, through the courtesy of Dr. W. W. Warnock, C.M.G.; of these 33 cases, 30 or 90 per cent yielded positive serological reactions.

Report (*d*).—Thirty cases of chronic bilharziasis were examined from Kasr-el-Ainy Hospital at the request of Mr. F. Cole Madden, F.R.C.S. Twenty-three of these, or 76·6 per cent yielded positive results. In seven it was negative. It is frequently impossible to demonstrate worms at the autopsy in cases of chronic bilharziasis. Owing to secondary infections, and the repeated deposition of ova in the walls of the hollow viscera (bladder and côlon), *focal* lesions can persist and even cause death to man long after the primary cause, i.e., the worms themselves, have ceased to exist. In cases such as these one would naturally expect to obtain a negative complement fixation, and indeed this is often the case.

The antigen used in the reports (*a*) and (*b*) was the saline extract; in (*c*) both saline and alcoholic extracts were used. This probably accounts for the high percentage of positive reactions obtained in this series. In (*d*) it was the alcholic extract alone.

(*b*) *As a Therapeutic Index to the Possible Effect of a given Drug on the Parent Bilharzia Worm.*

In the past it has been customary to adjudge the therapeutic value of any drug in bilharziasis according to the following criteria:—

(1) The temporary disappearance of vesical or intestinal symptoms.

(2) The diminution in the number of, or complete cessation of passage of ova in the dejecta, or the inability of such ova to hatch out miracidia. Such data, however, act merely as an index to the temporary amelioration of local conditions. They do not imply that a cure of the disease has been attained. This information tells one little concerning the fate of the true causal agents, the parent worms. Recent advances in our knowledge of bilharziasis, however, would now seem to afford a scientific, as opposed to an *empirical* basis, for estimating the effects of any given line of treatment. Thus:—

(1) The lethal action of various drugs on worms and cercariæ can be investigated *in vitro*.

(2) Monkeys can be readily infected with the parasite, and the effect of intravenous injection of any drug, found to exert a selective lethal action *in vitro*, tested.

(3) The complement fixation test, perhaps controlled by post-mortem examination, can be used to determine the effects of the drug on the parasites, either in man or in experimentally infected monkeys.

In 1917, I treated four cases with repeated intravenous injections of eusol, with negative results, as indicated by the facts that the complement fixation reaction remained positive and the eosinophilia undiminished.

On *a priori* grounds this was to be expected, since I have found that free chlorine exerts no specific lethal action upon the cercariæ.

Christopherson has recently reported favourably on the treatment of bilharziasis with tartar emetic, administered by the intravenous route.

Further confirmatory evidence of complete cure as controlled by this complement fixation reaction, and demonstration of the specific or selective action of tartar emetic in high dilutions on the adult bilharzia worms and cercariæ *in vitro* are suggested as being of the utmost value in elucidating this point.

X.—Conclusions.

As a result of this research I offer the following conclusions enumerated under five headings.

(1) Bilharzial parasites and their ova exert their deleterious influence on the tissues of their *definitive* host, man, mainly by the secretion or excretion of toxins, rather than by mere mechanical action, as has hitherto been supposed.

(2) The cellular-humoral response, both in man and in experimentally infected monkeys, is similar in principle to that observed in other helminthic, protozoal and bacterial infections. In bilharziasis there is an eosinophile leucocytosis and a corresponding increase in the eosinophile myelocytes in the bone marrow. The humoral response produces an immune body framed to neutralize the bilharzia toxins.

(3) By the employment of an alcoholic extract of the infected livers of snails (*P. boissyi*) as antigen and by *utilizing the technique I have described,* positive complement fixation reactions have been obtained in a high percentage of cases in man as well as in experimentally infected monkeys. In the latter, positive reactions may be established as early as the fifth week of the disease and invariably appear before the twelfth, that is, if the animal recovers. In men whose infection was of not more than two years' duration, 88·8 per cent. yielded positive results; in more chronic cases 74·2 per cent. As a general rule, it may be stated that, for man, the higher the eosinophilia, the stronger the fixation reaction and the greater is the percentage of cases yielding it.

(4) This is the first occasion on which a *specific* antigen has been obtained from the invertebrate intermediary, which will give a specific reaction with the blood of the vertebrate definitive host.

(5) The practical application of this reaction is twofold:—

(*a*) It is of diagnostic value early in the disease before localizing

symptoms have devoloped, and also in later cases in which ova are scantily distributed in the dejecta, especially in *B. mansoni*. It would prove of the utmost value in determining the *endemic index* of bilharziasis in the Nile Valley, if such a scheme were ever undertaken.

(*b*) It should be of the greatest value in estimating the effect of the intravenous administration of any drugs upon the adult parasites. In this respect the reaction should stand, in the future, in the same relationship to bilharziasis as does the Wassermann test to syphilis at the present moment, only I would emphasize that, unlike the latter, it is specific in the literal meaning of the term. There is no helminthic disease which I have investigated which will give pseudo-positive reactions as do certain allied protozoal diseases in the classical Wassermann test.

I am much indebted to Major P. H. Bahr, D.S.O., R.A.M.C., and to Professor F. Cole, Madden, F.R.C.S., for the stimulating interest and help they have rendered during the present investigation.

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OBSERVATIONS ON REFLEX PHENOMENA IN CASES OF SPINAL INJURY IN MAN.

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I.—Introduction.

The so-called "defence-reflex" in man is but an instance of that flexion-reflex of the limbs which has been observed in all other limbed vertebrates hitherto investigated.

The following observations we believe to demonstrate in man phenomena which have been found in other mammals but have not yet been shown for the human subject. Before we proceed to their description it will be useful to summarize the characters of the flexion-reflex. The flexion-reflex of a limb is part of the general reaction of the animal to stimulation, particularly of the skin of the same limb. It is accompanied, as part of the same reaction, by an extension of the opposite limb. The flexion-reflex is really an abstraction—a "type-reflex" (Sherrington)—composed of all the innumerable flexion-reflexes which are evoked by stimulation of the innumerable sensory end-organs of the limb. Its receptive field embraces all these sense organs—not only those in the skin itself, but also those of the deeper structures—tendons, muscles, and joints. In it all the flexor muscles contract equally (Sherrington)—though with different degree in reflexes of different strengths. All the extensor muscles relax reciprocally. The reaction consists itself in two parts, the immediate reaction and the after reaction. The immediate reaction is that of flexor contraction and extensor relaxation, and occurs during the continuation of the stimulus, although in weak responses all reaction may disappear while the stimulus still persists. The after-reaction is that which follows upon cessation of stimulation. It often consists in extensor contraction and flexor relaxation (the "extensor rebound" of Sherrington), but it may also appear as a sharp increment of flexion (Graham Brown), while sometimes alternate flexion and extension may be rhythmically repeated. Very weak stimuli normally give not flexion but extension in the same limb. It occasionally happens that the response in the opposite limb is one of flexion and not extension (Graham Brown and Sherrington). When stimuli are applied to both limbs simultaneously the reactions in either are an algebraic summation of the reactions which occur when either limb is stimulated separately (Sherrington). If one

[1] We are indebted to Lieutenant-Colonel N. J. C. Rutherford, D.S.O., R.A.M.C.—the officer commanding the General Hospital in which this Department is situated—for permission to publish this paper.

stimulus is made to cease before the other, the reaction in the remaining period of stimulation is an algebraic summation of the "rebound" effect from the stimulus which has ceased, and the immediate effect of the stimulus which still continues (Graham Brown). If the two stimuli are suitably graded the reaction during the period of double stimulation may consist in a rhythmic alternation of flexion and extension (Forbes, Sherrington, Graham Brown). It may be noted that not all parts of the receptive field are equally excitable. The skin of the sole of the foot seems peculiarly sensitive. It may also be noted that the reactions are obtained with greater ease and regularity in the spinal animal—that is, after a transverse lesion which cuts off the higher parts of the nervous system. One further point is of interest. A rapid division of the spinal cord about the level of the ninth or tenth thoracic segment in the decerebrate animal evokes rhythmic movements of progression in the lower limbs (Graham Brown). A final point of importance is this: that in the mammal the movements of the toes apparently do not act with quite the same regularity in the reflex as those at the other joints of the limb, and that the toes and fingers enter but slightly into the state of decerebate rigidity, i.e., "reflex standing" (Sherrington).

II.—The Receptive Field in Man.

In the normal man the flexion-reflex is difficult to obtain with regularity and when obtained is a partial reaction. The well-known plantar-reflex in which the great toe flexes, the foot is inverted and the tensor fasciæ femoris contracts, is obtained on stimulation of the sole of the foot. This reaction of flexion of the great toe is, however, in all probability not a part of the true flexion-reflex. But it seems to demonstrate that a certain small portion of the general receptive field of the flexion-reflex in normal man is regularly capable of effective stimulation under ordinary conditions.

This part of the receptive field is almost the only one stimulation of which gives a constant reaction in the normal subject. But certain stimuli applied to the back of the leg give a reaction which has not hitherto been described. If the leg be firmly grasped above the ankle and the tendo Achillis be pressed against the posterior surface of the tibia, the great toe flexes at the interphalangeal joint. Save for passive extension of the ankle, no other movement accompanies this. A similar movement is obtainable on deep pressure applied in either of the fossæ between the tendo Achillis and the external and internal malleoli respectively. The reaction strikes the observer very distinctly as a passive and not a reflex one. Yet it is not conditioned by the passive extension of the ankle produced by pressing upon the tendo Achillis—for if a similar passive extension is produced by pressing upwards against the posterior edge of the heel the great toe extends slightly. It is possible that it is produced passively by pressure upon the tendon of flexor longus hallucis. But in this case it is difficult to explain why it occurs with regularity when deep

pressure is applied in the fossa between the tendo Achillis and the external malleolus. The reaction reverses with complete reversal of the plantar-reflex in cases of spinal lesion. It has been present in all normal individuals that we have examined.

In a few normal individuals the flexion-reaction of the great toe is produced by deep pressure applied to the vastus internus and externus muscles, the gastrocnemius-soleus muscle, and when the skin on the postero-internal aspect of the leg is rubbed.

Summarizing this, we may say that in the normal man the receptive field stimulation of which gives with regularity a reaction—is fragmentary. It consists in the sensory structures in (*a*) the skin of the sole of the foot; (*b*) vastus internus muscle and gastrocnemius-soleus, and (*c*) the deep structures above the ankle and posterior to the bones of the leg (?). The flexion-reflex of the limb may of course be obtained by strong stimuli applied to almost any part of its surface in normal man, but not with regularity as a response to ordinary stimuli. That the reactions in (*b*) are produced by the stimulation of structures in the muscles, is shown by the fact that they are not obtained by a similar pressure applied to a fold of loose skin above the muscle.

In cases of spinal lesion the flexion-reflex of the limb may be evoked with regularity by stimuli applied to a wide receptive field. The response of the great toe is usually (but not always) one of extension. At the other joints of the limb flexion occurs. Because it has not been recognized that the receptive field for this reflex, includes almost every sensory end-organ in the limb, the reaction as evoked from different receptive end-organs has, unfortunately, been given different names and described as specifically different reflexes. Thus we have "Babinski's reflex"—the flexion-reflex of the limb as evoked by stimuli applied to the skin of the sole of the foot; "Oppenheim's reflex"—as evoked by a vigorous friction of the skin along the postero-internal aspect of the leg; "Schaefer's reflex"—as evoked by pinching the tendo Achillis; "Gordon's reflex"—as evoked by firm pressure between the heads of the gastrocnemius; the "Mendel-Bechterew reflex"—as evoked by tapping the bases of the third and fourth metatarsals; and so on. These, of course, are not separate reflexes but only different manners of evoking one and the same reflex, and it seems unnecessary to dignify these methods with special names. As is well known, in cases especially of complete transverse lesion of the spinal cord, the flexion-reflex of the lower limb—the "defence reflex"—may be evoked by a sharp pinch applied to almost any area of the skin on the same side of the body below the level of the lesion.

We have evoked the flexion-reflex of the limb in cases of spinal lesion in the following different manners, which are additional to those already described: Pressure applied in the fossæ between the tendo Achillis and the external and internal malleoli respectively; pressure upon the tendons of the long extensors of the toes; pressure upon the tendon of tibialis

anticus; pressure upon the body of tibialis anticus; pressure upon vastus internus and vastus externus; pressure upon rectus femoris; pressure upon tensor fasciæ femoris; pressure upon anterior abdominal wall about five centimetres internal to anterior superior iliac spine.

In all these cases the possibility that the reaction was evoked by pressure merely upon the skin and deep subcutaneous structures was excluded. These observations indicate merely that the receptive field includes not only the whole of the skin of the lower limb and lower part of the trunk, but also the deeper structures such as muscles and tendons—as in the lower animals.

While the stimulation of the superficial and deep (extero-ceptive and proprio-ceptive) parts of the common receptive field usually gives similar reactions, this apparently is not always so—as the following observation demonstrates. In a case of syringomyelia we observed the extension response of the great toe when the deep structures were stimulated by pressing upon the heads of the gastrocnemius muscle, or by firmly rubbing along the posterio-internal border of the tibia. Yet superficial stimuli applied to the sole of the foot gave the flexion response of the great toe.

III.—The Effective Field of the Flexion-Reflex.

The effective field of the flexion-reflex includes all or nearly all of the muscles of the limb. Those muscles to which the generic name "flexors" is applied contract. The extensors relax (the terms flexor and extensor are physiological ones—thus gastrocnemius is physiologically an extensor and rectus femoris is physiologically a flexor). In man it is difficult to demonstrate the phenomenon of muscular relaxation. We have observed the following muscles to contract in cases of transverse lesion of the spinal cord: extensors of toes, abductors of toes, flexors of the ankle, hamstrings, adductors of the thigh, rectus femoris (but not the other portions of quadriceps), tensor fasciæ femoris, the muscles of both sides of the anterior abdominal wall above and below the umbilicus. It is an interesting point that the rectus femoris should contract but not the other parts of quadriceps. These latter are functionally extensors of the knee. Rectus femoris is a flexor of the hip and has been shown experimentally in other mammals to be functionally distinct from the vasti and quadratus femoris. The bilateral contraction of the muscles of the anterior abdominal wall is also a point of interest. As far as we know it has not been observed in other mammals—probably because it has not been looked for. We have observed it to occur with regularity in a case of complete division of the spinal cord about the level of the fourth or fifth thoracic segment.

IV.—The Reflex Reaction, Immediate Reflex Phenomena.

In normal man the flexion-reflex of the limb is evoked with regularity only when strong stimuli are used, and is even then usually not a very

complete reaction. In cases of lesion of the spinal cord a much more complete and regular reaction may be obtained if a sufficient time (three to eight weeks) has elapsed since the infliction of the injury. The phenomenon of the reaction itself include those evoked by stimulation of one limb alone (simple reflex phenomena); and those evoked by stimulation of both limbs together (compound phenomena) which will be considered later.

The simple reaction consists in flexion at hip, knee, ankle, along with extension of hallux and sometimes abduction of the toes, all on the same side of the body. It is sometimes also accompanied by flexion of the lumbar spine (contraction anterior abdominal muscles). These movements are all those of the stimulated limb, but they are accompanied by movements in the lower limb of the opposite side. These crossed movements may consist in extension of the limb at hip, knee, ankle (equivalent to the "crossed extension-reflex" of other mammals) or sometimes of flexion (equivalent to the less common "crossed flexion-reflex" of other mammals).

The "immediate" phenomena of the reflex are those which occur during the period of application of the stimulus (for instance, a sustained pinch of a fold of the skin). Throughout this period the flexion of the limb may be sustained; there is a short period of latency after the commencement of stimulation. Then the limb begins to flex, and the flexion gradually increases in value until a maximum is reached. It may then remain at this limit of flexion throughout the remainder of the period of stimulation, or the flexion may gradually relax—it may indeed entirely disappear during stimulation if the stimulus is weak and sufficiently long sustained.

The reaction itself appears to be greater the stronger is the stimulus, but it is easily fatigued. In the reflex, flexion occurs in the effective field already described and is accompanied by extension of the hallux and of the other toes, and often by abduction of the four outer toes ("fan movements"). A point of interest lies in the apparent dissociation of this movement of the toes from the flexion at ankle, knee and hip. Thus in one case we obtained a well sustained flexion-reflex on maintained deep pressure upon the tibialis anticus muscle. The toe movements, however, appeared only at the commencement of stimulation and disappeared during the further continuation of the stimulus, although strong flexion persisted at ankle, knee and hip. In some cases the flexion-reflex in the limb of the stimulated side not only dies away during stimulation but is again re-established, although the stimulus itself is continued without alteration in value. The limb then performs rhythmic alternations of movement which will be described later.

A part of the immediate phenomena of the flexion-reflex are the movements which occur in the limb on the opposite side. In other mammals, under experimental conditions, the movement of the opposite limb is

usually one of extension (the "crossed extension-reflex") but is occasionally one of flexion. We have observed both these phenomena in man. The crossed extension-reflex occurs *pari passu* with the flexion-reflex of the limb of the same side. That is to say, that the movements of the two limbs are accurately reciprocal. The crossed extension-reflex is best seen where there is a certain amount of tonic flexion in the limb of the opposite side to that stimulated. Extension of the toes rarely accompanies the extension-reflex of the crossed limb, but is sometimes seen.

Occasionally we have observed the crossed reaction to be one of flexion. This crossed flexion-reflex seems to be favoured by the presence in the limb of a state of extension before the application of the stimulus.

The crossed flexion-reflex may occur in response to stimuli so weak that no movement occurs in the stimulated limb. Its latency is long. Where the uncrossed flexion-reflex is transient and dies away, its disappearance phase (that is, the phase of uncrossed extension) may be accompanied by flexion in the crossed limb. It is possible that the seeming pure flexion of the crossed limb where no movement occurs in the uncrossed limb, is really a reaction of this nature—that is, that it is the accompaniment of the disappearance phase of an uncrossed flexion-reflex which could not be detected by the ordinary methods of observation. In this connexion it may be remarked that in the case which exhibited this phenomenon flexion "rebound" phenomena (to be described later) were of greater extent than the immediate reflex phenomena.

These observations seem to show that, as in other mammals, the immediate phenomena of the reactions in the two limbs are accurately alternate. They seem to hint that the movements of the toes are by no means so stereotyped a part of the reflex as are the movements of flexion at ankle, knee and hip. As we have said above, the extension movement of the toes does not necessarily proceed *pari passu* with the flexion movements at ankle, hip and knee in the increased reflex, yet the movements at these last mentioned three joints seem to be fixed in relation the one to the other. Extension of the toes, as we have also observed above, may or may not accompany the crossed extension-reflex. In addition to these observations we may note that a well-maintained uncrossed flexion-reflex may be accompanied by phasic movements of the toes—that is, by rhythmically repeated extensions and flexions. The movements of the two lower limbs are not always, however, accurately alternate. Especially in response to pressure applied to the anterior abdominal wall opposite and near to the anterior superior iliac spine of one side, we have observed synchronous movements of flexion in the two lower limbs. These movements were markedly phasic—primary flexion giving place to extension during the continuation of the stimulus, but as far as we could judge the movements of flexion in the two limbs were nearly equal in strength and absolutely synchronous in time, as were also the secondary movements of extension. We may remark here that although, in the ordinary reaction,

a crossed extension movement accompanied an uncrossed flexion one, yet the adductors of the thigh often, if not invariably, contracted synchronously on the two sides. This movement is in itself one of some interest, for it may be connected with the adjustment of equilibrium necessary in the upright attitude, when one lower limb is raised from the ground. Thus the adduction of the extended limb is part of a movement which tends to bring the centre of the body into the perpendicular line through the heel which remains upon the ground; while the adduction of the flexed limb also helps the movement by bringing the main mass of that limb towards the antero-posterior perpendicular plane which passes through that line.

V.—"Reflex Reversal" in Immediate Reflex Phenomena.

Although the rule of reflex reaction in the lower limbs of the mammal is that flexion occurs in the limbs of the side stimulated, and extension in the crossed limb, under certain conditions the reactions may be made to reverse. Of these conditions one is the state of posture of the limbs at the time when the stimulus is applied. In a case of complete transverse division of the spinal cord we have observed this phenomenon of reversal in the movements of the crossed leg, as we have stated above. The uncrossed flexion-reflex of the right lower limb was accompanied by a well-marked extension—reflex in the crossed limb, if that limb was in a posture of maintained flexion when the stimulus was applied. If, however, that limb was in a state of extension, the crossed reaction was one of flexion. The respective movements of flexion and extension were observed to occur at ankle, knee and hip. Another condition under which reflex reversal may appear is repetition of stimulation. We have seen this reversal in the case of the plantar reflex in a man suffering from compression of the cervical spinal cord by tumour, and we believe that this form of reversal of the plantar reflex is by no means rare. The reflex to a fresh stimulus was at first one of double phase. Well-marked flexion of hallux at the metacarpo-phalangeal joint (no movement at interphalangeal joint) was of short duration and rapidly succeeded by well-marked extension which was more maintained. On repetition of the stimulus, the reaction finally became one of pure extension of the hallux, the primary flexion phase disappearing. This reversal was seen on the left side only.

VI.—"Rebound" Phenomena (Sucessive Reflex Phenomena).

In the mammal the final withdrawal of a sustained stimulus is followed by phenomena which are best termed "successive reflex phenomena" in contradistinction to the "immediate" phenomena which occur during the period of stimulation. In the uncrossed limb the immediate flexion is succeeded by a phase of slow decrease of flexion—the so-called "flexion after-discharge."

in strong reactions this is perhaps the usual successive phenomenon. Occasionally, however, on withdrawal of the stimulus, the uncrossed limb exhibited a sharp increase of the flexion then present in it—termed "flexor rebound after contraction." Yet again, on withdrawal of the stimulus there may be a sharp relaxation of the flexion then in being—"flexor relaxation after contraction." It is obvious that the flexion after-discharge is only a slow form of flexor relaxation. In the crossed limb these are usually reciprocal movements, but often no movements occur at all. The most common successive phenomenon in the crossed limb is flexion. It should be noted that flexor relaxation is synonymous with extension, and that in the mammal it is accompanied by reciprocal contraction on the extensor muscles of the same limb.

In a case of complete section of the dorsal spinal cord in man the successive reflex phenomena were very distinct. In the uncrossed limb the successive phenomena almost invariably took the form of an increase of flexion. This usually lasted for one or two seconds only, and having reached its maximum gave place to rapid relaxation. If the stimulus was sufficiently weak there might be no obvious movement of the limb during its period of application, but a well-marked flexion "rebound" on its withdrawal. This is a phenomenon frequently seen in other mammals. Stronger stimuli gave a transient flexion which disappeared during the period of stimulation, withdrawal of the stimulus being followed by a flexion rebound of yet greater extent. A still stronger stimulus conditioned flexion throughout its whole period, and an increase of flexion on its withdrawal. But if the period of stimulation was long continued, there was no flexion rebound, only a flexion "after-discharge." The rapidity of decrease of flexion in the after-discharge varied, and might be comparatively great.

As we have stated before, extension of the hallux and other toes accompanied the uncrossed flexion-reflex, but was more transient than the flexion at ankle, knee and hip, in strong reactions. It almost invariably disappeared during the period of stimulation. It was again seen on withdrawal of the stimulus where flexion rebound occurred.

In the crossed limb reciprocal successive phenomena were evident. On withdrawal of the stimulus an increase in extension was observed to be nearly synchronous with the increase of flexion in the uncrossed flexion "rebound." This was, however, not always easy to observe, as it needs a background of original flexion for its proper exhibition. This extension "rebound" in the crossed limb was often followed by a movement of flexion in it. The flexion might be of very great extent, and indeed was often the only successive phenomenon in the crossed limb. This was especially the case where that limb was originally in a posture of extension, and it appeared to be exactly synchronous in its phase of increase with the phase of decrease of the flexion "rebound" in the uncrossed limb. In other words, the successive reflex reactions in the two limbs were reciprocally alternate in character.

Just as nearly synchronous contraction of the adductors of the two thighs was observed in the "immediate" phenomenon, so too was it observed in the successive phenomena when it had died away before the termination of stimulation. But whereas the uncrossed adductors appeared to commence to contract shortly before the crossed ones in the "immediate" phenomenon (we estimated the difference in time at about 0·25 second), in the successive phenomena the contraction appeared to be synchronous on the two sides. On one occasion flexion "rebound" appeared to be nearly synchronous in the two limbs. When there is flexion "after-discharge" (that is, slow decrease of flexion) in the uncrossed limb, there may be a reciprocal slow increase of flexion in the crossed limb. Phasic increase and decrease of extension of the toes were occasionally seen in the immediate reflex phenomenon of the uncrossed limb, especially when the stimulus was a sustained pinch of the skin. Similar phasic movements of the toes would then accompany a well-marked and sustained flexion rebound in that limb.

Stimuli applied to the lower part of the abdomen above or near Poupart's ligament seemed to be peculiar in that nearly synchronous flexions occurred as immediate and successive reflex phenomena in both limbs. They were accompanied by extension of the toes of both sides. The movements in the two limbs might be apparently of equal extent, and there was absolutely no difference observable in their times of commencement. Contraction of the crossed and uncrossed abdominal muscles was part of the successive phenomena. The immediate and successive contractions of the abdominal muscles were observed to include rectus abdominis and the obliques of both sides.

VII.—Compound Reflex Phenomena.

In the mammal when stimuli which evoke antagonistic movements in a limb are applied together, the resultant reaction is an algebraic summation of the two (Sherrington). Thus, if one stimulus gives a marked flexion and the other a slight extension, when both are applied together the limb gives a movement of flexion less than that seen when the flexion-producing stimulus is applied alone. We have observed this phenomenon in man. Thus when the stimuli used were such as to evoke slight flexion in either limb when given singly, little or no movement might be seen when they were applied together—the stimuli of course being given to both limbs simultaneously. If the stimuli were stronger, flexion was observed to occur in both limbs but to be smaller in extent than when either stimulus was given alone. If a strong stimulus was applied to the right limb and a weak one to the left, flexion was observed in the former, and extension in the latter, but both these movements were smaller than the movements obtained on applying the strong stimulus to the right limb alone. Slight flexion and not extension might occur in the weaker stimulated limb. Exactly similar

algebraic summations were observed in the successive reflex phenomena. In the case of stimulation of the abdominal wall by deep pressure on one side near Poupart's ligament, the immediate reaction was one of synchronous flexion in the two limbs, but the flexion though great in extent was not well maintained. It gave place to extension during the continuation of the stimulus, and, on withdrawal of the stimulus, a similar movement of flexion succeeded by extension was observed in the two limbs. The duration of the flexion was about two seconds. When stimuli were applied on the two sides synchronously, the flexion movement in both limbs was greater than that which occurred when a single stimulus was given, but its duration did not appear to be markedly altered. This increase in flexion was seen in the immediate and successive phenomena.

VIII.—Rhythmic Phenomena.

Rhythmic reflex phenomena are not uncommon in the mammal in response to an arrhythmic stimulus. They are best obtained when nearly equal antagonistic stimuli are matched against each other, as one of us has shown, but they may also be obtained in response to a maintained stimulus applied to a single limb. This is perhaps especially the case immediately after the division of the thoracic cord in its lower part (eighth to tenth segments). It is perhaps significant for what we have to say, that in the decerebrate cat, rapid division of the spinal cord at this level often starts well-marked rhythmic movements of progression, which may persist for a minute or more in the lower limbs. With the exception of the scratch-reflex, the rhythmic reflexes of the lower limbs of the mammal are more or less incomplete forms of progression. We have observed these to occur in man. In a case of complete division of the spinal cord in the upper thoracic region rhythmic reflexes were hard to obtain. This case was one of a Bulgar in whom the spinal cord was cut across by a bayonet in the fourth thoracic segment. Rhythmic reflexes were not obtained during the application of antagonistic stimuli to the two limbs, but on unilateral stimulation occasionally an indication of rhythmic rebound phenomena was obtained. Alternate flexions occurred in the two lower limbs, but rarely more than two flexion phases were seen in either limb. On pinching the skin of the right lower limb, rhythmic movements occurred in the toes of the same limb, both as immediate and successive phenomena, but the flexion at the other joints of the limb was not rhythmic. In this case automatic movements occasionally occurred alternately in the two limbs. The movement in either limb consisted in flexion followed by extension—the whole double phase lasting one or two seconds. These movements, however, were not again repeated in the limb.

In a Serbian who had sustained an almost complete division of the spinal cord at the seventh thoracic segment, we found it possible to obtain rhythmic alternate movements of both lower limbs, many times repeated

by simultaneous stimulation of the soles of both feet. In a case of a tumour compressing the lower cervical segments of the spinal cord and probably affecting the upper part of the thoracic spinal cord (not yet confirmed), well-marked rhythmic movements were obtained. On maintained deep pressure between tendo Achillis and the left internal malleolus, well-marked long-maintained rhythmic movements were observed, especially in hallux. The rate of the movements was twenty-five in thirty-five seconds. If a similar stimulus was then applied on the right side, the rhythmic movements disappeared. At first there was a transient increase of extension in the left hallux followed by rapid decrease, and slow increase again. When the stimulus was removed from the right side (being retained on the left), the rhythmic movements reappeared in the left hallux. They also might break through the double stimulation if that was long maintained, and further increased when the right stimulus was then removed.

In a case of transverse myelitis, the prick of a pin on the sole of either foot started rhythmic alternate movements of flexion and extension at ankle, knee and hip, of both lower limbs. These were not of great extent and were comparatively slow—the phase repeating in about two seconds. In this case, and on the evidence of these movements, we guessed the level of the lesion to be in the lower thoracic part of the spinal cord. The myelitis was actually at the sixth thoracic segment.

In a case of acute polyneuritis rhythmic involuntary movements of the toes were observed on bilateral stimulation of the soles of the feet; rhythmic alternate movements occurred in both lower limbs. In either limb these consisted in flexion at ankle, knee and hip, followed by extension. For a short period the plantar reflexes were extensor in type, and he had a difficulty in micturition which later disappeared. He also had lumbar pains. In this case we suspected myelitis and again guessed the level from these phenomena to be in the lower thoracic region of the spinal cord. A transverse myelitis was found in the eighth thoracic segment.

IX.—On the Diagnostic Value of Rhythmic Reactions.

We have spoken above of the presence of rhythmic alternate movements of the lower limbs in response to stimuli which are applied either to one lower limb alone, or to both lower limbs simultaneously. These rhythmic movements are really forms of the so-called "stepping reflex," which is the basis of the movements of progression in the limbed vertebrates. When they occur in man the rhythmic movements are shallow—that is to say, they are of no great extent at any joint in the limb. They are extremely like the so-called "narcosis progression" described by one of us in other mammals. They are similar to the movements found by one of us to occur immediately after division of the spinal cord in the lower thoracic part in the decerebrate cat.

The point to which we wish to draw attention here is the site of the

lesion in the cases in which we have observed it. That site was the sixth, seventh or eighth thoracic spinal segment, in the cases in which definite evidence was obtained.

It seems to us legitimate to emphasize the possibility that the occurrence of these rhythmic reactions in man may be of diagnostic value in pointing to the site of the lesion, as in the lower thoracic spinal cord and probably in its sixth to ninth segments. The occurrence of the phenomenon would seem also to point to a complete or nearly complete compression or division of the spinal cord in that region.

X.—Conclusions.

In this paper we have given an account of reflex phenomena encountered in man. The greater part of these have been observed previously in other mammals, under experimental conditions. Many of them are described here for the first time as they occur in man. This does not, however, mean that they are of rare occurrence in the human subject, but only that they have probably not been systematically sought before. A few of these observations would seem to be novel. One is perhaps of diagnostic significance. We think, however, that the phenomena which we have described are of chief interest in that they show that the limb reflexes of man are strictly comparable in their various characteristics, with the limb reflexes of other vertebrates. Indeed, apart from the phenomena, which can only be seen when the movements of isolated muscles are graphically recorded, almost all the characteristics and variations of the vertebrate limb reflex have been observed by us in man.

Clinical and other Notes.

A NOTE ON CIRCULATORY VARIATIONS AND THEIR EFFECTS, OBSERVED DURING AIR FLIGHTS.

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A question arose some months ago on one of the Fronts, in consequence of some temporary indispositions observed among airmen, whether the symptoms noted could be accounted for by blood-pressure changes during flight, and particularly in descent from high altitudes. This suggestion was advanced by a Flight Commander of the Royal Flying Corps. Such symptoms were headache, giddiness, sense of fullness at pit of stomach, nausea, restlessness and general discomfort; occasionally fainting or syncope; auditory disturbances. The opportunity occurred to collect some facts and figures on this matter in a short series of flights soon afterwards; and the following are notes of five air flights made on July 29, August 2, and September 3 and 4. I publish them not so much for their value as data, but in the hope that they may be useful for comparison with notes obtained by other observers who have experience in this interesting subject.

The flights were undertaken to ascertain—

(*a*) Blood-pressure variations.

(*b*) Pulse-rate variations due to changes in altitude and air temperature during flight—particularly in rapid descent from high altitudes, and

(*c*) Any consequent physical phenomena in the individual.

The notes on the fifth flight (see Table V) indicate the results on the individual in the above respects, of conditions of air travel involving, in addition, rapidly changing plane and direction of flight, e.g., "loop-looping", "tail sliding," "spiral nose diving."

The prevailing conditions of flight make it necessary that observations of pulse-rate and blood-pressure shall be made on oneself, thus impairing their accuracy as compared with observations made objectively. The descriptions of sensory phenomena, too, are those of subjective impressions.

A sphygmomanometer of the Lauder Brunton type was used to record blood-pressures (*vide* Tables II *et seq.*). It has a pressure gauge with dial scaled to record in millimetres of mercury the point at which the radial pulse is obliterated by pressure on the brachial artery. It was worn on the left upper arm with a forearm splint extending to the finger tips, so as to eliminate any fallacy from accidental flexion or hyper-extension at the wrist, in determining the exact obliteration point of the radial systole. Some difficulty was found, in doing this, in differentiating between the already very weak radial impulse and capillary pulsation at the tip of the observing finger. Another condition which interfered

with the complete accuracy of blood-pressure readings was coldness and numbness of the fingers of the free hand in rapid flight at high altitudes. The left forearm became noticeably swollen at the wrist—the only unbandaged portion—by the tourniquet effect of the sphygmomanometer in action; so that after obliteration it was not easy to define, within a millimetre or two either way, the precise point at which the radial impulse returned. I think this explains the wide

TABLE I.—JULY 29, 1917.

Height (feet)	Hour a.m.	Pulse-rate	Remarks
Ground	6.45	90/112	..
1,000	..	120	..
2,000	..	112	..
3,000	..	110	..
4,000	..	110	..
5,000	..	110	..
6,000	..	110	..
7,000	..	90	..
8,000	..	84	..
9,000	..	90	} Nausea.
10,000	..	90	
11,000	..	120	Retching and vomiting.
12,000	..	96	Very cold extremities.
13,000	..	96	Respiration rather laboured, especially on movement. No vertigo.
14,000	..	102	..
15,000	..	102	No nausea.
16,000	..	120	Sharp cold.
16,000	..	120	..
15,000	..	108	..
14,000	..	102	..
13,000	..	102	..
12,000	..	104	..
11,000	..	102	..
10,000	..	100	..
9,000	..	90	..
8,000	..	90	..
7,000	..	90	Feeling very cold.
6,000	..	90	Breathing easier.
5,000	..	84	..
4,000	..	84	Feeling much warmer.
3,000	..	84	..
2,000	..	84	..
1,000	..	120	After 1,000 feet "nose dive."
Ground	..	72	Roaring and singing sounds and "woolliness" in ears (temporarily relieved by Valsalva method on oneself) which persisted all day.

departure from mean blood-pressure in the readings recorded between 3,000/7,000 feet of ascent on the first occasion (see Table II, August 2).

In Tables II, III and IV the observations of the blood-pressure and pulse-rate were made by an independent observer before and after flight. Altitude readings were taken with an anæroid barometer and air temperature with a Fahrenheit thermometer. Only pulse-rates and altitude could be recorded at the first flight.

It was ascertained that the average speed of flight was approximately fifty-eight miles per hour; and, of travel, up to eighty-five miles.

1st	Ascent, to	16,000	feet	took	46	minutes;	descent	13½ minutes.
2nd	,,	16,500	,,		52	,,	,,	12 ,,
3rd	,,	15,000	,,		61	,,	,,	7 ,,
4th	,,	15,500	,,		55	,,	,,	12 ,,

The rapidity of descent made readings at 1,000 feet impossible, but those figures obtained are probably sufficient to give the information required.

TABLE II.—AUGUST 2, 1917.

Height (feet)	Hour a.m.	Air temperature (Fahrenheit)	Pulse-rate	Blood-pressure (mm.)	Remarks
Ground	6.12	77·0	72	126	..
1,000	..	80·6	72	125	..
2,000	..	78·8	84	126	..
3,000	..	78·8	84	140	..
4,000	..	78·8	78	136	..
5,000	..	78·8	84	140	..
6,000	..	77·0	96	136	..
7,000	..	75·2	90	132	..
8,000	..	71·6	90	128	..
9,000	..	66·2	90	128	..
10,000	..	61·7	84	127	Respiration conscious
11,000	..	59·45	84	126	..
12,000	..	57·2	84	126	..
13,000	..	54·68	96	125	..
14,000	..	53·6	90	125	Respiration weighty
15,000	..	48·6	90	124	..
16,000	..	47·3	90	122	..
16,500	..	46·4	96	122	..
16,500	..	..	..	..	..
16,000	..	..	..	..	..
15,000	..	..	..	..	..
14,000	..	..	..	..	..
13,000	..	..	..	..	..
12,000	..	..	96	120	..
11,000	..	..	..	..	..
10,000	..	..	..	..	..
9,000	..	..	..	..	..
8,000	..	..	..	..	..
7,000	..	..	78	..	..
6,000	..	..	..	..	..
5,000	..	..	..	..	..
4,000	..	..	..	..	..
3,000	..	..	..	..	..
2,000	..	..	84	..	..
1,000	..	..	..	..	..
Ground	..	..	..	122	Tinnitus aurium noticeable all day; no vertigo

Re Blood-pressure.—Taking the records in order (Tables II, III and IV) the first fact which becomes clear is that the readings are comparable only in different altitudes of the same flight. They bear no constant relation in different flights. For instance, the second and third series show in ascent minimum and maximum pressures respectively, between 122/128 milimetres and 122/130 millimetres—

(I disregard the readings in Tables II for 3,000/7,000 feet of the ascent as unreliable for reasons already given)—whereas the figures for the fourth flight (Table IV) show an appreciably lower mean pressure, 108/120 millimetres, though the range between minimum and maximum is not markedly different from those of the second and third. These were made immediately after a full meal, while the fourth was before any food had been taken that day. The observer on all three flights was free from any indisposition. As regards descent, the pressure readings show no wide range from the mean of those recorded in ascent: nor are there wide differences between minimum and maximum in any of the three descents. On the occasion of the fourth flight (Table IV) it will be noted that at 12.45 p.m., an hour after landing and immediately after a full meal, the blood-pressure was 122 millimetres as recorded by another medical officer. Just before the meal, however, some first experiences of an impressive kind subjectively, as requiring rapid and repeated readjustments of an accustomed sense of environment, had been undergone in the way of "loop-looping," "tail sliding," "spiral nose diving" and so on.

TABLE III.—SEPTEMBER 3, 1917.

Height (feet)	Hour a.m.	Air temperature (Fahrenheit)	Pulse-rate	Blood-pressure (mm.)	Remarks
Ground	9.39	94	112/96/90	130	..
1,000	..	89	72	130	..
2,000	..	87	78	(?)	..
3,000	..	82	90	125	..
4,000	..	79	84	130	..
5,000	..	76	80	126	..
6,000	..	72	84	128	..
7,000	..	67	84	130	..
8,000	..	63	90	128	..
9,000	..	57	78	130	..
10,000	..	53	84	125	..
11,000	..	52	84	128	..
12,000	..	54	84	125	Sun on thermometer; breathing laboured on exertion
13,000	..	53	84	122	
14,000	..	49	75	126	..
15,000	..	47	75	126	Respiration heavy.
15,000	..	..	78	125	..
14,000	..	..	..	..	..
13,000	..	..	..	..	..
12,000	..	..	..	..	..
11,000	..	..	..	..	..
10,000	..	..	78	..	..
9,000	..	..	..	..	..
8,000	..	..	..	..	..
7,000	..	..	..	..	..
6,000	..	..	..	..	..
5,000	..	..	..	..	..
4,000	..	..	..	..	..
3,000	..	..	..	..	..
2,000	..	..	..	125	..
1,000	..	..	..	..	..
Ground	..	..	..	125	Tinnitus aurium; no vertigo

Re Pulse-rate.—The series in Table I shows a higher mean than those of the subsequent flights. The observer on this occasion was the subject of an acute gastro-enteritis which had been in progress for several hours. There was severe retching and vomiting a few minutes before flight, again at 11,000 feet, during the ascent. These phenomena probably explain the higher mean rate. The aural signs noted on this record were much more marked than after the later flights.

TABLE IV.—September 4, 1917.

Height (feet)	Hour a.m.	Air temperature (Fahrenheit)	Pulse-rate	Blood-pressure (mm.)	Remarks
Ground	9.30	82	76	108	..
1,000	..	80	78	108	..
2,000	..	77	72	108	..
3,000	..	74	68	108	In shade
4,000	..	74	70	108	In sun
5,000	..	72	70	101	..
6,000	..	68·5	64	108	..
7,000	..	66	68	108	Over enemy trenches; marked pulse acceleration on unexpected machine-gun fire
8,000	..	61	76	109	..
9,000	..	56	72	110	..
10,000	..	52	76	112	..
11,000	..	50	80	110	Steep "banking"
12,000	..	46	68/70	112	..
13,000	..	52	80	122 (?)	Thermometer in sun
14,000	..	50	80	115 (?)	..
15,000	..	40/43	88	114	Very cold; "blue lips and nose"; breathing weighty; pulse occasionally intermitting
15,500	..	38	..	120	..
15,500	..	..	90	..	..
15,000	..	..	..	..	..
14,000	..	..	..	..	..
13,000	..	..	..	120	..
12,000	..	..	..	..	..
11,000	..	..	..	..	..
10,000	..	..	..	..	..
9,000	..	..	..	..	..
8,000	..	..	..	..	..
7,000	..	..	..	..	..
6,000	..	..	..	..	..
5,000	..	..	..	..	..
4,000	..	..	88	120	..
3,000	..	..	..	110	..
2,000	..	..	..	..	..
1,000	..	..	..	..	..
Ground	..	..	..	108	Tinnitus aurium; no vertigo

The subsequent series show pulse-rate variations in normal health with no disturbing influences beyond those due to altitude and exertion.

There are no striking features in the figures except (1) an increase from 84 to 110 in the first flight (Table I) coincident with a "nose dive" of 1,000 feet during the descent which, at 2,000 feet, the pilot was asked to make; (2) the high rate on first climbing into the aeroplane before starting, which,

however, fell to 90 before flight; (3) on Table IV, a very marked acceleration on the unexpected opening of machine-gun fire; and (4) occasional intermitting during the same ascent between 14,000/15,500 feet.

Other points noted were that at and beyond 10,000 feet respiration becomes conscious and the need to breathe is felt more as altitude increases beyond that height. This is specially noticeable on exertion, such as turning the head and shoulders round or rising to look downwards over the side of the machine. No attempt was made to make a count of one's own respiration. An objective observation of value is that of the pilot who remarked on the observer's "blue nose and lips" at 15,000 feet.

The last ascent of the series (see Table V) made—immediately after the fourth

TABLE V.—SEPTEMBER 4, 1917.

Height (feet)	Hour a.m.	Pulse-rate	Blood-pressure	Remarks
Ground	..	89/90	118/122	..
500	..	..	..	..
1,000	..	..	..	..
2,000	..	..	..	..
3,000	11.29	68	120	..
4,000	..	80	122	Watching for pilot's signal for commencing descent and evolutions
4,800	..	80	122	..
4,800	..	100	128	Before "loop-looping," "tail slide," "spiral nose dive," etc.
4,000	..	..	..	..
3,000	..	..	..	..
2,000	..	..	..	..
1,000	..	..	..	..
500	..	72	122	After the above evolutions, frequently repeated, during descent from 4,800 ft. No nausea; slight vertigo and deep inspiration during evolutions in mid air
Ground	..	..	..	Tinnitus aurium
Ground	12.45 p.m., one hour after second landing	Pulse 102/104	Blood-pressure 123	After first meal of the day

flight—was undertaken to a sufficient height to allow, in descent, a number of evolutions which involved marked departure from the normal in lines and planes of travel. These departures were not only very marked but were also very difficult to keep pace with. They were undertaken in order to observe any influence on pulse-rate and blood-pressure these disturbances of the accustomed sense of equilibrium may have. Such results do not appear of much concern.

An examination of the attached tables shows that high flight and rapid descent do not appear to have any constant effect on the circulatory system. It is not apparent that the recorded effects are of any considerable import. The tendency to increased rate of pulse at high altitudes is probably due to physio-

logical causes. This increase, associated with the peripheral vaso-motor constriction incidental to the cold of high altitudes, may, without notably altering general blood-pressure, so modify blood-distribution as to produce increased internal vascularity. This again is relieved at a rapid rate on quick descent to low, warm altitudes; and thus, reflexly, may be accountable for those sensory symptoms noticed by airmen from time to time on landing.

No account has been taken of the important question of neurological reaction resulting from the nature of the work, such as:—

(1) Alertness, on reconnaissance, against exposure to hostile action; (2) air combat; (3) length of service between rest periods; (4) age; (5) general health.

The nerve fatigue of constant air work on active service will differ in degree with the stability of the individual, but in every instance it must stand a ruling factor. Another, and probably the chief influence to be considered is his previous medical history with regard to malaria, dysentery, sandfly fever and such like debilitating affections to which he is liable on service in tropical and semi-tropical areas.

WHEELED STRETCHER CARRIER ADAPTATIONS FOR TRENCH AND MOUNTAIN WARFARE.

By Colonel R. J. BLACKHAM, C.M.G., C.I.E., D.S.O.
Army Medical Service.

Officers of the Medical Services who have been engaged in the great battles on the Western Front, especially those who have served in Italy, during the present War, have had reason to bless the foresight which provided us with wheeled stretcher carriers. These carriers have not only been of the utmost value in the form in which they have been supplied, but have lent themselves to adaptation for the formation of (*a*) *quasi* mono-wheeled stretchers for the trench boards of France and Flanders and the mountain paths of Italy, and (*b*) light stretcher carriers for mule draught in the Alps.

(*a*) *Quasi Mono-wheeled Stretcher Carrier.*

It will be seen from fig. 1 that by a very simple modification consisting of two wooden blocks, size 5 inches by 2½ inches by 7½ inches, carrying cross pieces, size 2½ inches by 1½ inches by 2 feet 2 inches, the Miller James stretcher wheels can be adapted for use on trench boards or on mountain paths.

The wheels are closed and by fitting the grips of the springs into a recess of the blocks, all backward and forward displacements of the stretcher are prevented (see elevation fig. 1, A).

To this wooden block, marked A on the fig. 1, is bolted a cross-piece slightly wider than an open stretcher, i.e., 2 feet 2 inches, and fitted with grips at each end, which retain the stretcher in position. (Fig. A illustrates the block in detail.)

The wooden blocks are easy to make and can be fitted to the wheels or removed from them in practically the same time that it takes to fix or remove a stretcher from the unaltered carriage.

The stretcher carrier serves a double purpose. It affords greater comfort to the patient, and, equally important from the military point of view, conserves the energy of the stretcher bearers, enabling them to do at least two journeys for every one they would be able to do by hand carriage alone.

Stretcher carriers adapted for trench boards by this method were used with great success in the fighting east of Ypres in 1917.

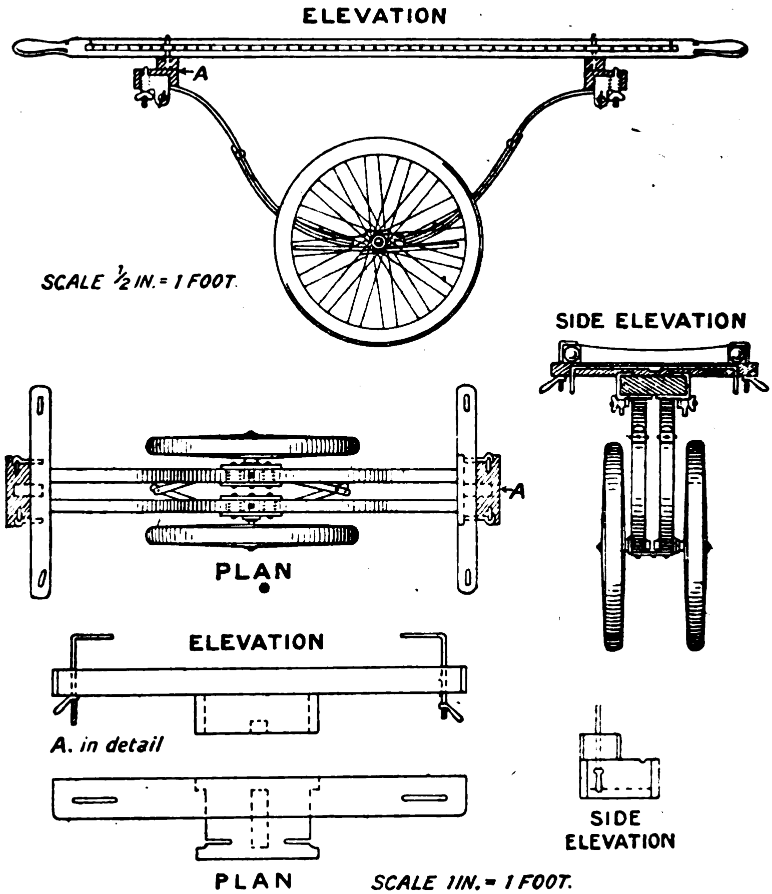


FIG. 1.—Adaptation of Miller James stretcher wheels for use on trench boards or mountain paths.

(*b*) *Stretcher Carrier for Mule Draught.*

Another modification helping to relieve the arduous work of the stretcher bearers is shown in fig. 2, which illustrates a wheeled stretcher carrier for mule draught.

The stretcher wheels are attached to the shafting in the following manner:—

The shafts are connected by three transverse bars (1), (2) and (3). Into the

two hindmost bars (2) and (3) are mortised two parallel battens. These battens are twenty-three inches apart, i.e., the width of an open stretcher.

A rectangular framework is thus formed, the side bars of which serve to fix both stretcher and stretcher wheels. The stretcher wheels are fixed by clamping the side bars with the grips of the front springs (4). The front runners of the stretcher are passed through a slot (A) in each bar, and fixed in position by a

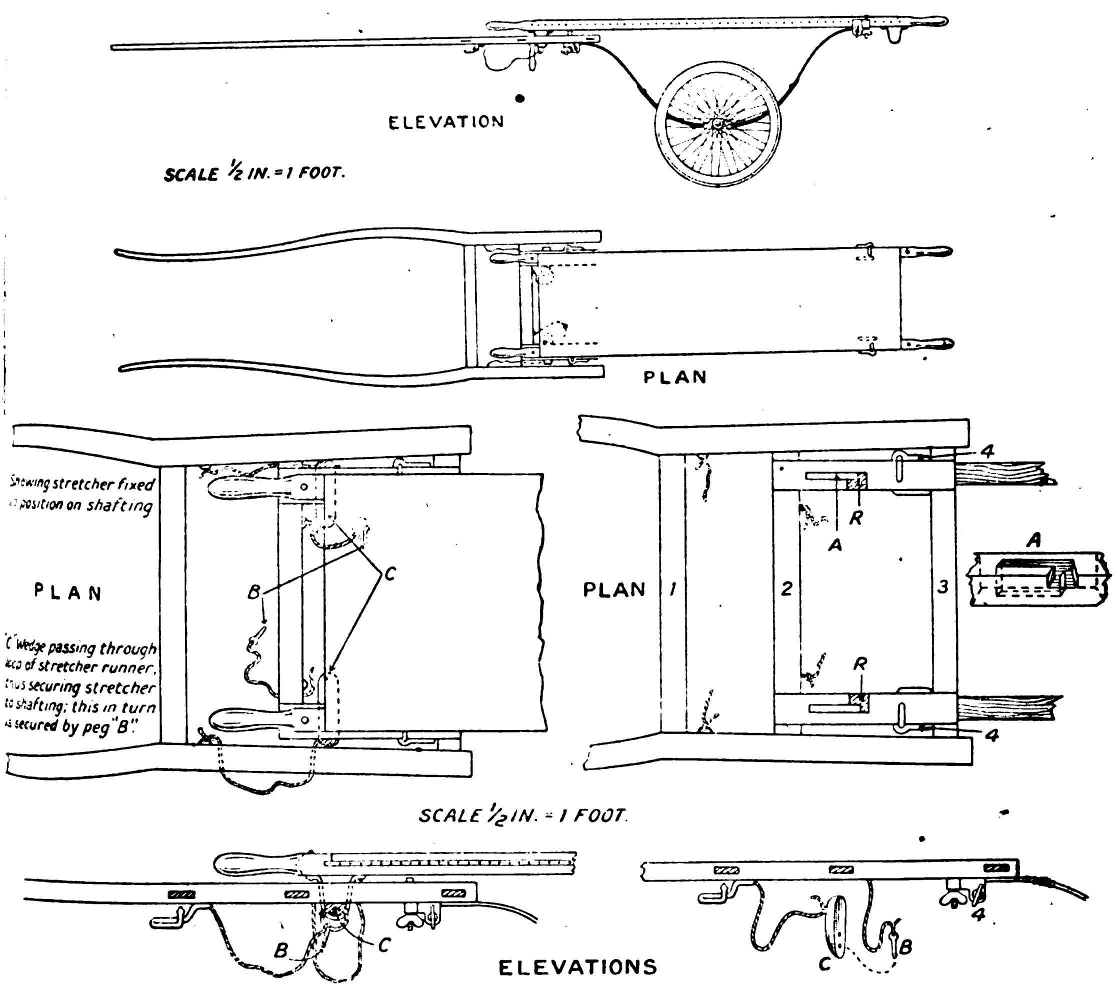


FIG. 2.—Adaptation of Miller James stretcher carrier for mule draught.

wedge (C) passing through the runner loop. A recess has to be made to take the traverse of the stretcher (R). The wedge (C), which consists of a solid boat-shaped piece of wood, is fixed to the shafting by a cord and staple. It is held in position by a peg (B). The back of the stretcher is fixed in the usual way by the grips of the back springs.

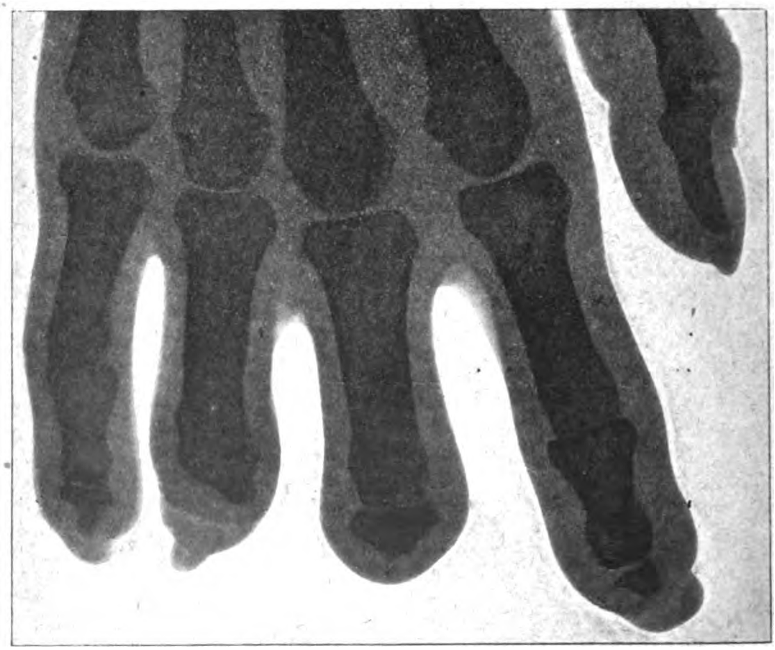
This modification is easily and quickly adjusted. It has been tried with great success in the Alps. Not the least important advantage to the A.D.M.S. endeavouring to use every available man for getting away his wounded, is that it enables him to employ to the fullest extent his Horse Transport A.S.C. Drivers, a gallant and devoted body of men who are frequently disappointed by playing an obscure part in the arduous task of clearing a modern battlefield.

LEPROSY DIAGNOSED BY X-RAYS.

By Captain H. B. BILLUPS.
Royal Army Medical Corps.

In the *British Medical Journal*, dated December 4, 1915, p. 814, Major Neve, F.R.C.S.E., describes and illustrates a case of leprosy in which a definite diagnosis could only be made by means of X-rays. The following case is very similar, and may be of interest:—

The patient, U——, aged 47, a low class Hindoo hillman from Almora, near



Naini Tal, belonging to an Indian Labour Corps, came on board the Hospital Ship "Glengorm Castle" on March 19, 1918. He had been ill since December 28, 1917, with cough, laryngitis and mucopurulent expectoration, and had had pleuritic fluid, showing slight lymphocytosis, removed from the left side of the chest. He was wasted and weak and without much doubt was suffering from

phthisis, although no tubercle bacilli had been found in the sputum. The condition of the left hand attracted attention. The middle and ring fingers were about half their usual length. The nail was missing from the middle finger and the nails on the index, ring and little fingers were mere claws. These claws could be moved about quite freely, showing that the terminal phalanges in each case had nearly disappeared. The middle and terminal phalanges of the middle and ring fingers were represented by mere button-like bones. The thumb was quite normal, as also the right hand and all the toes. The print of the radiograph demonstrates the condition better than a mere verbal description. This complete disappearance of phalanges without destruction of the fleshy parts is recorded in Manson's account of leprosy in his "Tropical Diseases." No reliable history of contact, inheritance, or previous illness could be elicited. At first the patient stated he had had an accident, but on further cross-examination he said that the fingers had swelled up about four years ago and had been bad for six months. He had evidently been afraid of leprosy and had offered a goat, gold and silver to his gods. There were a few indefinite pale areas on the arms. Anæsthesia was found on the ulnar side of the left hand, and there was doubtful thickening of the right ulnar nerve. With these exceptions there were no other nervous or skin conditions pointing to leprosy, so that, as in Neve's case, the diagnosis practically rested on X-ray evidence.

THE TREATMENT OF CHRONIC RELAPSING MALARIA WITH SALVARSAN SUBSTITUTES.

By Captain HUGH MILLER.
Royal Army Medical Corps.

The treatment of cases of chronic relapsing malaria in the Army by quinine, arsenic and other ordinary methods has proved most unsatisfactory. Such cases undoubtedly improve while under treatment in hospital, but the great majority seem to relapse soon after discharge.

From time to time there have been references in the journals to the treatment of such cases with salvarsan or its substitutes, but with the limited access one has to medical literature in Egypt I have been unable to find any definite statistical account of any series of cases treated in this way.

In order to put the treatment to as searching a test as possible I selected the most hopeless cases I could find—cases that for the most part had been several times in hospital and had been more or less under treatment with quinine for long periods and yet continued to relapse, cases that might fairly be regarded as the failures of quinine. The great majority of these cases had originally been infected in Macedonia, and the time that had elapsed between the original infection and their coming under my observation was as follows:—

More than 2 years	14 per cent.
From 18 to 24 months	37 ,,
,, 12 to 18 ,, ...	20 ,,
,, 6 to 12 ,, ...	25 ,,
Under 6 months	4 ,,

I selected such cases because, owing to the impossibility of keeping in touch with cases for long after discharge, the fact of an ordinary case not relapsing while under observation would prove nothing, but if one could prevent these frequently recurring cases from relapsing for even a couple of months there would be a fair indication that the treatment had had some effect.

In fixing the details of treatment one had to have regard to the fact that the patients must not be kept an unduly long time in hospital. After trying various methods I finally decided to give each patient four intravenous injections at intervals of five days, the doses being 0·3, 0·4, 0·5, and 0·6 gramme respectively. The first twenty cases of this series did not receive the full doses; the amounts varied but were always less than the dose I ultimately fixed on. The preparation used was either kharsivan or arsenobillon and no difference was noticed in their action. The drug was given in half a pint of saline and each injection occupied about ten minutes. In every case the needle was introduced directly into the vein; in no case was it found necessary to cut down on the vein.

In all seventy-seven cases were treated, but as in four the treatment was not completed, the full number treated was reduced to seventy-three. The cases were as a rule in hospital for at least two weeks after the completion of treatment and in convalescent camp for two months. Arrangements were made whereby relapses at the convalescent camp were notified to me, so that each case was in a sense under my observation for at least ten weeks. Instructions were given that these cases should not be given quinine unless relapse occurred.

The number of relapses noted may be in excess of the true number, for at the time these cases were in convalescent camp an epidemic of influenza was prevalent and some of the so-called relapses may possibly have been attacks of influenza. The only notification I received was that the patient had pyrexia; I have, however, included all such cases in the list of relapses. Conversely it must be admitted that it is quite possible that relapses may have occurred without my having been notified.

Of the seventy-three cases twenty-six were reported as having relapsed; the remaining forty-seven apparently did not relapse for two to three months after treatment was completed. This makes the percentage of relapses thirty-five. If we deduct the first twenty cases where the full dose was not given and of which twelve relapsed, the rate falls to 26·4 per cent.

Several of my cases had definite malarial attacks in hospital while under treatment with quinine orally and intramuscularly—none relapsed while under salvarsan treatment. Three of these were having forty grains of quinine intramuscularly daily and yet relapsed. In all nineteen cases had attacks a few days prior to my starting treatment, and in all these benign tertian parasites were found and in one malignant tertian were also reported as being present.

The earliest relapse that occurred was eighteen days after the *completion* of treatment and the average time for the twenty-six cases was twenty-eight days.

A point of interest is that for a time very severe reactions were obtained and of these cases reacting severely only one relapsed. The reactions were at times so severe that, fearing there might be something wrong with the drug, I discontinued using that particular consignment and got a fresh supply. It may have been mere chance, but still there is no doubt that these cases did better than the others.

The general improvement in the patients' condition was most remarkable. Nearly all my cases were anæmic, debilitated, and worn out by repeated attacks; they all improved in a most striking way and before they left hospital looked for the most part comparatively healthy.

A medical board was recently held at the convalescent camp to which most of my cases had been sent for the purpose of classifying cases of chronic relapsing malaria. Although most of my cases had been before treatment among the worst we had had, yet only three of them were invalided to England.

In four cases the treatment was not completed. Two of these were elderly men, anæmic and greatly debilitated. Each was so ill, the one after his first injection and the other after his third, that it was deemed more prudent not to proceed further. The third case after his third injection had an acute otitis media and a couple of days later developed a fairly severe attack of jaundice which ultimately cleared up. The fourth case was one that it was difficult to understand. He had little or no reaction after his first two injections, but after the third he had a severe reaction, developed an acute toxic jaundice with marked cerebral symptoms and died four days later. The kharsivan used for this injection was from the same batch that was producing fairly severe reactions in most of the other cases. Whether there was anything wrong with the drug was not determined, but certainly there was reason to suspect it and its use was discontinued.[1]

Although the percentage of relapses is fairly high, thirty-five per cent, or deducting the first twenty cases 26·4 per cent, yet it should be remembered that nearly all these cases were among the worst that could be found. There can be no doubt that salvarsan preparations have a very considerable influence in cases of malaria. It should be remembered that no case relapsed for thirty-three days from the commencement of treatment, though several were having daily rigors before I commenced and while they were having quinine. Whether the salvarsan acts directly on the parasite may be a debatable point—personally I think it does—but there can be no doubt as to its very remarkable action on the general health of the patient. As I have said, nearly all the cases were sallow, thin and greatly debilitated. In the great majority of cases before treatment was concluded they had gained weight, had lost their sallow appearance and in general felt very much better. As most of the cases were "quinine sodden" part of this improvement may have been due to the withholding of quinine while restraining the action of the parasite.

If I have the opportunity of treating a further series of cases I should like to follow the salvarsan treatment with a course of quinine for two or three weeks. Also if it were feasible I should like to extend the interval between injections to ten days or more, increasing the interval as much as one could without allowing relapse to occur.

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[1] Messrs. Burroughs Wellcome and Co. state that the batch of kharsivan from which this supply was obtained consisted of over one thousand doses. As no complaints were received from any other quarter, one must conclude either that the Egyptian climate had had some effect on the drug or that these acute reactions were due to some unascertainable cause.

The number of cases dealt with is much too small and the period during which they were under observation much too short to justify one making any dogmatic statements about ultimate results, but enough has been done to justify a fuller and more extended trial. Although I think my results, judged from the standpoint of relapses, are encouraging, yet I would rather base the claim for more extended trial on two other facts: namely, the general improvement in the patients' condition and the immediate cessation of malarial attacks when salvarsan was injected. As regards the first of these I am unable to give any precise data, but all who had the opportunity of observing my patients were greatly impressed with the rapid improvement in their condition. Regarding the second point I would again emphasize the fact that no case relapsed for eighteen days after completion of treatment, which means for thirty-three days from the commencement. The opinion seems to be gaining ground that many cases of chronic relapsing malaria have had too much quinine; if that be so then we require some other drug that is capable of preventing malarial attacks. All I would claim meantime is that salvarsan substitutes have the power not only of preventing, at least for a time, malarial relapses, but at the same time exercise a most beneficial effect on the patients' general condition. These two facts are of such great importance that of themselves they would certainly justify a much more general use of these drugs.

Report.

THE TRACHOMA PROBLEM.

By Colonel W. T. LISTER, C.M.G.
Army Medical Service.

The introduction of coloured labour into France has brought about one of the largest, if not the largest, problem of dealing with trachoma (apart from that in Egypt) which the English have had to cope with for nearly a century.

The organization introduced for the segregation of the infectious cases and their treatment having been in force for over fifteen months, the present moment seems a good opportunity to report the progress that has been made.

Summary.

Trachoma has been found in the Chinese, Egyptians and the Cape Boys.

The Cape Boys, forming the Auxiliary Horse Transport, are a comparatively small body and the incidence is slight.

The Egyptians, as would be expected, had a high incidence, but as they were to leave France at the end of 1917, the organization for their treatment was only of a temporary character.

The Chinese came to stay and in great numbers (some 100,000). Though the incidence was comparatively low, the total number of cases of trachoma is considerable (some 8,500). The disease untreated (1) spreads rapidly and (2) cripples labour thus:—

Infectious Nature of the Disease.—(1) The first examination of two companies revealed twelve cases in one and fifteen in the other. Owing to the importance of the disease not being recognized by the authorities, the treatment advised was not carried out and the notified cases of trachoma were not moved. In eight weeks' time there were fifty-nine cases in one company and eighty-one in the other. If such dissemination occurred in eight weeks it is reasonable to suppose, if no treatment throughout had been adopted, that in a year's time nearly the whole of the Chinese in France would have become trachomatous with disastrous results on labour.

Incapacitating Effect on Labour.—(2) A trachoma company was sent up to an army area for about six weeks and was untreated. At the end of this time the average number of men off duty daily for eye trouble was about thirty, and fifteen men had been sent down to headquarters as unfit to work. Here again it is reasonable to expect that if no treatment had been adopted, at the end of a year a very high proportion of the coolies would have been unfit to work and many of them would have lost their sight.

By the methods adopted, though there have been some 8,500 cases of acute infectious trachoma, 5,500 cases of suspicious conjunctivitis, 86,000 contact cases,

the disease is diminishing. The individual cases are improving. The number of men off duty daily for eye trouble is from 0·025 to 0·09 per cent, and it is no greater in the trachoma companies than in the clean companies, and we know of no instance of the disease having spread from the Chinese to our own troops or to the French population. In my preliminary report, sent in during the month of May, 1917, I pointed out how the disease was originally discovered, first in the Egyptians and later in the Chinese companies; and how, with the co-operation of Colonel Sir Wm. Leishman and Colonel Beveridge it was immediately recommended that the disease should be treated in all thoroughness and that orders should at once be telegraphed to Egypt and China, "that no cases with definite trachoma granulations or any acute conjunctivitis should be allowed to embark from Egypt or China or to disembark in France." In a later message to China it was urged that, when it was found difficult to obtain coolies without some trachomatous taint, the coolies with trachoma should be isolated as far as possible on board ship. (Sent from War Office.) In spite of these precautions large numbers of men of both nationalities arrived in France with the disease, though as time went on there was a great diminution in the incidence amongst the Chinese.

A short résumé was given dealing with the dangers of trachoma, its history, and the havoc which it caused when, after the Napoleonic wars, a "fountain" of trachoma seemed to spread out from Egypt nearly all over Europe, and this by the agency of troops. Our problem was to ameliorate, as far as possible, the condition of those who had trachoma and to keep them fit for work, to prevent the spread of the disease to our own troops, the French population, and to the unaffected men of their own companies. At first it was thought that the infected men in each company could be segregated from their fellows without breaking up the companies themselves and that the coloured companies could all work in a few definite centres where treatment could be carried out. It was soon found, however, that these labour companies were needed all over the British area, which rendered treatment in each company impossible, for trachoma can only be satisfactorily treated by medical officers with ophthalmic knowledge, and of these there were not nearly enough to go round. A new scheme had therefore to be formulated.

The disease being strictly contagious and not air-borne, and the infection being confined to the ocular discharge, the broad principles to be followed were:—

(1) To comb out and group the affected men into separate companies (trachoma companies) where the men could sleep and wash together without risk of spreading the disease to the unaffected.

(2) To limit as far as possible the ocular discharge by appropriate measures and to treat the individual cases.

(3) To sterilize at frequent and regular intervals the towels both in the clean and dirty companies, so that if these were exchanged from man to man the risk of passing on any infection, that might be lurking in a towel, would be reduced to the minimum.

(N.B.—The roller towel is said to have been the chief means of spreading trachoma in the English Army in old days.)

(4) To organize periodic inspections of the "clean companies."

The Egyptians.—The Egyptians were highly affected with the disease, for at

a low estimate 45 per cent either had or had had trachoma. From the point of view of treatment they are difficult to deal with. They could not or would not work except under their own rais, who had recruited them from their own villages, and thus trachoma companies could not be formed. Treatment had therefore to be carried out in each company as far as was possible. But trachoma being endemic in Egypt and the incidence of the disease there being high (ninety-five per cent MacCallan), the responsibility with regard to the unaffected was not so heavy, also the fact that the Egyptian Labour Companies were returning to Egypt at the end of 1917, made the necessity for complete organization less important. They improved very considerably with treatment, fewer men were off duty for eye trouble and the quality of their work was much better, as was borne out by the testimony of their non-medical officers.

Cape Boys.—In the last year a few (some thirty-eight) of the Cape boys were found to be trachomatous (about 3 per cent). These have all been combed out and placed in a separate section which works, sleeps and washes together, and where they are all treated. By this means the least possible disturbance has been caused to the work of this unit.

Chinese.—Our main problem has been with the Chinese, of whom there are roughly 100,000 working for the British in France, and in whom the incidence is about eight per cent—the number of trachoma cases being about 8,500. At first it was as high as thirteen per cent, but with the greater care in selection of the coolies in China the incidence of the disease fell, in the later batches, as low as three per cent.

The scheme of treatment has been gradually evolved and improved, and its adoption has worked with satisfactory results as will be seen from the summary.

I.—Preliminary Segregation.

In the preliminary segregation of the affected coolies we had two separate problems.

(1) All men arriving at Chinese Headquarters had to be examined for their eyes by experts. The infected cases were grouped into trachoma companies which in turn were sent to work at "trachoma treatment centres." In this inspection there was considerable difficulty in classification. Conjunctivitis is rife amongst the Chinese, especially amongst those who work in dusty localities, and, there being no definite pathological tests as to whether a given case of conjunctivitis is or is not trachoma, the diagnosis rests on clinical experience. Until a trachomatous conjunctivitis has developed characteristic clinical signs, it is impossible to discriminate between the two. It was thus found that numerous cases of conjunctivitis were met with of doubtful nature. If these cases had been kept at Noyelles until the diagnosis was substantiated, many weeks of labour would have been lost. Again, if a man with a non-trachomatous conjuctivitis was placed in a trachoma company he would almost certainly acquire trachoma, while if a trachoma case was placed in a clean company he would be a centre of infection. It was therefore decided that three sets of companies should be formed :—

X (" clean ") companies, containing the apparently unaffected cases ;

Y companies, containing cases with conjunctivitis of doubtful nature, and

Z (trachoma) companies, containing cases of undoubted trachoma.

It should be noticed here that the so-called clean companies are formed of

men who in reality are all "contact cases." The men came over in ships closely crowded together and probably used towels and blankets indiscriminately, and many of the men, though apparently clean on first inspection, might develop trachoma later, hence the importance of regular periodic inspection (see IV).

The clean companies could be sent anywhere that they were needed, under the supervision of medical officers who had not necessarily had ophthalmic training.

The Y and Z companies were to be sent to certain definite places, designated "trachoma treatment centres," where they would be under the supervision and treatment of an ophthalmic specialist. This is a point on which Labour Authorities should be perfectly clear. Such companies should not be sent up country, for there they can as a rule get no proper treatment or supervision.

"Trachoma treatment centres" have been formed at Calais, Vendroux, Boulogne, Dannes, Saigneville, and at Abancourt.

If a new "trachoma treatment centre" were required, companies should be grouped with not less than 2,000 cases, so that a whole-time ophthalmic specialist could be appointed to look after them. A smaller number does not fully occupy the time of an ophthalmic specialist and therefore his time would be wasted.

The labour of inspection of the men arriving in their thousands at headquarters was very great, and I should like to state definitely that had it not been for the splendid and thorough work done at No. 3 Native Labour Hospital, with the whole-hearted and efficient co-operation of Lieutenant-Colonel Gray (Medical Advisor to the Chinese) and carried out mainly by Captain Stuckey, Captain Hughes and Captain Tomlin, the whole scheme would have been a failure.

(2) There were already in France numerous mixed companies, some men affected and some clean; and these companies were scattered over a wide area. We had therefore to inspect all these men and comb out the infectious cases, which were either sent back to Chinese headquarters or to a neighbouring trachoma company.

The inspection of those companies already at work was also very laborious; it lasted over many weeks and involved a great deal of travelling.

Every man in each company had both lids everted and was classified X, Y, or Z, and the numbers of the Z and Y cases were taken. The Y cases were treated in their own companies and the Z cases sent to headquarters to be placed in trachoma companies. On one day 11,000 lids were turned and the corresponding 5,500 coolies were classified. This was carried out chiefly by Major Cunningham, Major Derby (ophthalmic consultant to the U.S.E.F.), Captain Wharton, Captain Whiting, Captain Stirling and myself.

Inspection Parades.—The examinations were made at times arranged to suit the Labour Authorities so as to obstruct work as little as possible, and were thus chiefly made on Sundays when the men generally had a day off. It is understood that in spite of the large numbers examined, only a very few hours of work were encroached upon by this inspection. On arrival at the camp the men were formed up in three or four rows corresponding with the number of examining medical officers and came up in turn for inspection.

At a table, just behind the examining medical officers, a recording officer sat who made notes in duplicate of the examination. A dot was made for each case examined in the appropriate X, Y or Z column and the numbers of the Y and Z cases were noted. The X cases after examination were allowed to fall out at once,

but the Y or Z cases were handed on to an N.C.O, who took the man's number from his brass identity disc or wristband and called it out to the recording officer. On the table were bowls of disinfectant and towels for cleansing the hands of the examining officers after touching an infectious case. The examination of 500 cases by three medical officers and one recording officer took as a rule from twenty-five to thirty minutes, working rapidly. At the end of the examination one had, therefore, a record of the total number of men seen, the identity numbers of the men who had trachoma and of those who had conjunctivitis.

One copy of the record was left with the Company Officer, who saw that the Z cases were sent to headquarters, and the Y cases were specially treated by the medical officer.

Nationality........Chinese. Labour Company....No. 73.
Location..........Isberques. Date ....Sept. 30, 1917.

	Z—Nos.		Y—Nos.			X		X	
1	·	10752	·.·.·	·.·.·	59221	·.·.·	·.·.·	·.·.·	·.·.·
2			·		59635	·.·.·	·.·.·	·.·.·	·.·.·
3					59660	·.·.·	·.·.·	·.·.·	·.·.·
4					59827	·.·.·	·.·.·	·.·.·	·.·.·
5					54908	·.·.·	·.·.·	·.·.·	·.·.·
6					57025	·.·.·	·.·.·	·.·.·	·.·.·
7					54571	·.·.·	·.·.·	·.·.·	·.·.·
8					208	·.·.·	·.·.·	·.·.·	·.·.·
9					54799	·.·.·	·.·.·	·.·.·	·.·.·
10					57668	·.·.·	·.·.·	·.·.·	·.·.·
11					53739	·.·.·	·.·.·	·.·.·	·.·.·
12						·.·.·	·.·.·	·.·.·	·.·.·
13						·.·.·	·.·.·	·.·.·	·.·.·
14						·.·.·	·.·.·	·.·.·	·.·.·
15						·.·.·	·.·.·	·.·.·	·.·.·
16						·.·.·	·.·.·	·.·.·	·.·.·
17						·.·.·	·.·.·	·.·.·	·.·.·
18						·.·.·	·.·.·	·.·.·	·.·.·
19						·.·.·	·.·.·	·.·.·	·.·.·
20						·.·.·	·.·.·	·.·.·	·.·.
21						·.·.·	·.·.·		
22						·.·.·	·.·.·		
23						·.·.·	·.·.·		
24						·.·.·	·.·.·		
	Z—1		Y—11			240		199	
						X—439			

Total number examined—451.

As stated in my original report, trachoma is a very intractable disease. Our objective is amelioration and prevention of dissemination in order to keep the men at work; combined with as much curative treatment on simple and efficient lines as is practicable.

Under the most favourable conditions of supervision and treatment a complete cure can rarely be effected under twelve months and it often takes considerably longer. It should also be noted that apparently cured cases are very apt to recrudesce under unfavourable conditions. It would therefore be highly unadvisable to take apparently cured cases from Z companies and place them in X companies. That is to say, once a Z company always a Z company. In the Y companies the apparently cured cases are in daily contact with a certain proportion of the trachomatous.

Without a complicated system of observation compounds, it would be equally unwise to transfer these apparently cured cases to clean companies.

II.—Limitation of the Discharge by Appropriate Treatment.

Every Chinese coolie gets some eye treatment every day, whether clean or infected.

(*a*) *X* ("*Clean*") *Companies.*—As already stated, conjunctivitis is exceedingly common amongst the Chinese. Many have long-standing inflammation, with reddening and some amount of thickening of the conjunctiva, but without granules, scarring or pannus. Such a condition, under the irritating influence of dust from heaving coal or hay, etc., or working on the docks or in the sand, is liable to exacerbation and readily becomes complicated with catarrhal ulceration of the cornea.

It is important that such cases should have the conjunctiva washed out daily with some astringent antiseptic lotion, which keeps it healthy and limits the discharge. The eyes of those without any conjunctivitis are none the worse, indeed are all the better, for daily irrigation. The "daily drop treatment" can be carried out in a very simple way. It is always done in the men's off-time so as not to obstruct labour, and the Medical Officer should keep a careful time-table in order to arrange for the regular treatment of the different batches of men in their off-duty hours.

The batches of off-duty men, or when possible the whole company, are lined up in two rows. The men squat on their heels, a common position of rest among Orientals; a ganger stands behind, supporting the head and raising the upper lids, while the man pulls down his own lower lids. The medical orderly with a jar of lotion in his left hand, and an ophthalmic dropper in the right, inserts a few drops, seriatim, in the two eyes. The ganger and orderly, a pair to each row, pass down the line from man to man. In this way the drop treatment is carried out so rapidly that the whole 500 can usually be treated in from ten to fifteen minutes. The treatment is thus neither laborious nor does it occupy much time. The men recognize its value and often resent being accidentally overlooked; some indeed ask for a second application.

Any Y case in an X company with corneal ulceration or mucopurulent discharge is treated separately with atropin or by painting with nitrate of silver solution, etc., as is necessary.

The Medical Officer is advised to look through the whole of the company once every two weeks as opportunity offers. It is a good plan for him to do this at the "dropping parade," preceding the ganger and orderly and turning the lids of each case as he goes down the line. In this way he can see how the men are getting on and can select any case for special treatment or detect any case which may have developed trachoma.

The astringent drops used are a solution of boric acid ten grains, zinc sulphate two grains to the ounce. Very marked improvement of the coolies' eyes took place as soon as this universal drop treatment was adopted.

(*b*) *Y Companies.*—These companies, as already stated, are formed of men all of whom had conjunctivitis of a suspicious character at the preliminary examination at headquarters. It was to be expected therefore that some of these would develop into cases of definite trachoma. Treatment is carried out on much the same plan as in the X companies, but the more severe cases with definite conjunctival discharge are regularly painted with some silver solution (silver nitrate or protargol) until the discharge ceases.

Cases of trachoma which may develop, are combed out and sent either to headquarters or to a neighbouring trachoma company. The detection of such cases needs the experience of an ophthalmic specialist, and it is for this reason that the Y cases should be placed at trachoma treatment centres—an untrained medical officer may either become too easily alarmed, and, by fearing every inflamed eye is trachomatous, may break up a company unnecessarily or, by overlooking infectious cases, allow a considerable spread of the disease.

(*c*) *Z* (*Trachoma*) *Companies.*—These companies which are placed at "trachoma treatment centres" are under the care of ophthalmic specialists. In the worst cases the granules are "expressed." Those with chronic thickening of the conjunctiva are treated with sulphate of copper crystal. Those with discharge, with silver nitrate solution (two per cent). Those who are progressing favourably, with sulphate of copper drops or the boric and zinc lotion. Complications such as keratitis, corneal ulcer, etc., are treated on ordinary lines.

The success of the treatment depends upon the care and perseverance of the Medical Officer. As has already been mentioned in the summary, the rapidity with which the disease can spread in a mixed company which has had no treatment is alarming.

Trachoma is the commonest cause of blindness in the East, and those ophthalmic officers who have seen a great deal of trachoma in China, state that they have seen large numbers of the population in that country who have become blind from the disease when untreated.

Since the above treatment has been carried out in France it is rare to see any of the severe type now that was so common on the arrival of the men; also the trachoma specialists constantly bear witness to the improvement which is taking place in the companies under their care and this is borne out by my own observation.

That trachoma untreated leads to a great loss of work power has already been mentioned; thus in the trachoma company sent up to an army area and which had no proper treatment, the disease assumed a virulent and incapacitating character. When in October, 1917, this company was sent to the Base and came under the

supervision of Captain Hine, ophthalmic specialist at Camiers. Out of the 588 men, sixty-eight needed "expression" of granules and there were many cases with severe mucopurulent discharge.

On the average thirty men were off duty daily for eye trouble. In December the average number off duty had fallen to seven daily, while in January and February, 1918, the average number off duty daily was down to two, that is 0·34 per cent. This splendid improvement was due to the vigorous treatment instituted by Captain Hine, together with the devotion of Captain T. L. Harrison, who during the cold winter months got up regularly at about four o'clock every morning to treat his company before they went out to work. The moral of this instance is this—a company neglected for some six weeks took about three months to regain its full working efficiency.

Lieutenant J. A. C. Smith in Dannes has had equally good results owing to his splendid perseverance. When he first took over the treatment of two Z companies in November, 1917, the average number off duty daily of the 1,000 men was twenty-five. It is now over four months since any man has been incapacitated from work because of his eyes.

Captain Horatio Matthews has also got a fine record of his two trachoma companies at Vendroux. Thus amongst 1,000 cases in April only two were excused duty and one sent to hospital; in May no cases were off duty for eye trouble; in June two were excused duty, eleven were sent to hospital for trichiasis; and in July of this year only one man had to be excused duty.

III.—Sterilization of Towels.

The towels wipe the discharge from the eyes and thus become infection-bearers. It has long been known that towels and handkerchiefs are a great source of danger in trachoma. The Chinese do not employ handkerchiefs to any great extent, but use their towels for every conceivable and inconceivable purpose.

With the large numbers it was at first difficult to arrange for the sterilization of the towels. It was at the excellent suggestion of Captain McMurray, who has been in charge of the trachoma cases at Calais for over a year and who has done very valuable work, that boilers were supplied to the companies so that on stated days the men on returning from work threw their towels into the cauldron, where they were boiled for half an hour; meanwhile an issue of clean ones was made. This procedure is of great importance.

The rule is now that the towels should be sterilized twice a week; but unfortunately this plan is not universally carried out owing, it is stated, either to the difficulty of supplying boilers or to the shortage of fuel in certain districts.

Sterilization of towels should however be insisted upon either by boiling or some other method.

IV.—Periodic Inspections.

The numbers of the so-called "clean" cases (contact cases) are so great, and the distribution of the X companies is so wide, that it is practically impossible for one or two senior ophthalmic officers to visit all these companies every two months, yet it is very important that they should be kept under ophthalmic

supervision, for a certain amount of trachoma is bound to crop up from time to time.

As noted above the medical officers in charge of these companies have often had no ophthalmic training and are therefore not in a position to recognize and comb out the trachoma cases.

A system of ophthalmic report cards has been instituted at the suggestion of Major Cunningham, of which the following is a sample.

OPHTHALMIC REPORT.

Date .... C. L. C. No............. X. Y. Z.

Location ....

Strength.................Date Coy. left H.Q..

Nature of Work ....

Average No. of Men off DAILY for Eye Trouble ....

No. of Trachoma cases sent to H.Q. in last month ....

of these the number so severe as to be unfit for work ....

Is daily Treatment regularly carried out? ....

Are Towels sterilized twice a week regularly? ....

X Coy. No. of Trachoma cases (if any) ....
No. of cases with Conjunctival discharge ....

Y Coy. No. of Trachoma cases (if any) ....
No. of cases with Conjunctival discharge ....
No. of apparently cured cases ....

Z Coy. No. of SEVERE cases of Trachoma ....
No. of MILD " " ....
No. of apparently cured cases ....

Remarks ....

Reports to be sent in MONTHLY to the Consulting Ophthalmic Surgeon,
c/o D.D.M.S., Boulogne.

Signature of M. O. ....

The reports sent in monthly are kept in a card index and will show the state of the companies. It will thus be easy to look up the records of any company and note its ophthalmic state month by month.

If there is much conjunctivitis or suspected trachoma in a given company this one will be visited. If no men are off work and there is little or no conjunctival discharge regular visiting is unnecessary.

The whole British area is now divided up into definite districts and regular inspections of the X companies is provided for; thus the ophthalmic specialists at Noyelles have undertaken the onerous work of inspecting all the Army areas together with that of Abbeville and Amiens; while the companies in Rouen, Havre, and Dieppe areas are to be supervised by the Senior Ophthalmic Specialist of the corresponding Base, while in the northern area of the line of communication the supervision is under the control of the consultant.

It is obvious what disastrous results on labour would have followed by this time if this disease had been ignored. This alone is of great importance, apart from the inhumanity of allowing such large numbers of men working for the English Government to become infected, necessitating wide dissemination of the disease in China on their return, and entailing the causation of a very definite amount of avoidable blindness. The men have been kept at work, so that, as already stated, only 0·025 per cent to 0·09 per cent are off duty daily for eye trouble and the percentage is no higher in the trachoma companies than in the X and Y companies. The quality of work is decidedly better, which is testified to by several of the non-medical officers in charge of Chinese companies.

We know of no instance of the disease spreading to our own troops or to the French population.

Before ending this report I should like to state that throughout the work Major Cunningham's expert knowledge of the subject has been of the greatest value, and his untiring zeal in coping with the various difficulties as they arose has been an important factor in the success of the scheme.

Another important factor has been the hearty co-operation of the labour authorities, who realized from the first the importance of dealing with the disease and that this was the best means of keeping the coolies at work. They have put themselves to considerable inconvenience in order to meet whole-heartedly the medical requirements.

Great thanks are due to Colonel Beveridge, who recognized the importance of the disease from the beginning and who gave his strong support to the organization throughout.

Acknowledgment must be made of the assistance rendered by the medical authorities for issuing orders for the carrying out of the various recommendations and for allowing an advisory officer to have direct administrative dealings with the Labour Directorate. It was only after this was permitted that prompt action was possible and that real progress in this scheme was made.

Reviews.

TRENCH FEVER: REPORT OF COMMISSION MEDICAL RESEARCH COMMITTEE, AMERICAN RED CROSS. London: Henry Frowde, Hodder and Stoughton. 1918. Pp. viii + 446.

The time has gone by when trench fever can be looked upon as a new disease. So much has been written and published about the condition that we are now in possession of a fairly clear idea of its nature, means of transmission and complications.

In consequence, the literature of the subject is certain for the future to be subjected to close and critical examination. What is looked for is not so much a mass of detail—that has already been presented—as a clear view of the whole problem, a view sufficiently comprehensive to omit no salient particular and yet sufficiently in focus to relate the phenomena of this disease to the whole field of morbid conditions.

Our main criticism of "Trench Fever," the Report of the Commission of the Medical Research Committee, American Red Cross, is that while the trees are very numerous the forest is less easy to discern. The Report, indeed, leaves nothing to be desired as far as details of the symptomatology of the disease are concerned; it deals exhaustively with the experiments carried out to determine the part played by the louse as the agent of transmission, and it affords plenty of information regarding the presence of the virus in the blood of infected persons and the possibility of its transmission from man to man by means of the body louse—the excreta of these insects after feeding on trench fever patients being shown to be infective.

These, admittedly, are important and well-established facts. The new facts of the volume are less easy to discover. One of these is undoubtedly the infectivity of the urine of patients, another the infectivity of filtrates of louse excreta and urine.

As to the exact part played by lice, one of the most interesting observations is discussed on the last two pages of the work. An experiment was conducted by Captain A. M. Pappenheimer and First-Lieutenant John H. Mueller, in which three volunteers were subjected to the bites of infected lice. One of these developed trench fever, the other two did not; "it was concluded that the virus of trench fever may be conveyed by the body louse." And it is there recorded that the man who contracted the disease scratched himself, whereas those who failed to do so, did not.

Other workers have definitely identified the louse as the special carrier of the disease, and further have established the fact that infection is carried, not by the bites of the insects but by their excreta—which may, no doubt, contaminate the bites. Needless to say this discovery alters the whole aspect of the problem, for infected excreta may be blown about in any direction.

The most signal service performed by the Report is the clear distinction which is made between trench fever and the enteric group, especially paratyphoids A and B. This distinction was by no means easy to establish, for the symptoms of the two conditions, the enlarged spleen, rose spots, the general malaise, the tendency to bradycardia in the initial attack, all tended to confusion. We think that this part of the Report is likely to remain classical as well in its form as in its substance.

The actual causative organism of the disease remains to date a matter of uncertainty. Various claims have been made but we are not aware that any of these have been substantiated. Indeed the Report correctly sums up the situation when it declares :—

"The organism causing trench fever may apparently be most appropriately classified as a resistant filterable virus."

THE SCIENCE AND ART OF DEEP BREATHING. By S. Otabe. London: Bale, Sons and Danielsson, Ltd. 1919. Pp. viii + 114. Price 5s. net.

This small volume is rather a naively written disquisition on that hardy annual, deep breathing. The author, a Japanese doctor who has practised deep breathing for many years, claims that it is the panacea for such widely divergent diseases as tuberculosis, chronic gastro-intestinal catarrh and obesity, to name only a few of the conditions in which it may effect a cure. The little book contains nothing strikingly new or unorthodox. His account of the influence of deep breathing on the mind is quite interesting. The author is to be congratulated on his excellent command of the English language.

INDEX TO VOLUME XXXII.

C.N. = Clinical and other Notes.

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

JANUARY, 1919.

EXTRACTS FROM THE "LONDON GAZETTE."

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

St. James's Palace, S.W.,
November 18, 1918.

The King has been graciously pleased to give orders for the following appointment to the Most Excellent Order of the British Empire, for distinguished service in connexion with military operations in France and Flanders, to be dated June 3, 1918:—

To be Officer of the said Most Excellent Order:—

Capt. David Hammand Fraser, M.C., Royal Army Medical Corps.

For an act of gallantry not in the presence of the enemy.

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

St. James's Palace, S.W.,
November 18, 1918.

The King has been graciously pleased to give orders for the following appointments to the Most Excellent Order of the British Empire, for distinguished service in connexion with military operations in Mesopotamia, to be dated June 3, 1918:—

To be Officers of the said Most Excellent Order:—

Temp. Capt. David Forbes Borrie, Royal Army Medical Corps.
Major Samuel Richard Christophers, C.I.E., M.B., Indian Medical Service.
Capt. William Dunlop, Royal Army Medical Corps (Special Reserve).
Temp. Capt. Edward Norman Glover, Royal Army Medical Corps.
Major Frederick Percival Mackie, M.D., F.R.C.S., Indian Medical Service.

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

St. James's Palace, S.W.,
November 18, 1918.

The King has been graciously pleased to give orders for the following appointments to the Most Excellent Order of the British Empire, for distinguished service in connexion with military operations in East Africa, to be dated June 3, 1918:—

To be Officers of the said Most Excellent Order:—

Temp. Lieut.-Col. Donald Macaulay, Royal Army Medical Corps.
Major George Darell Maynard, South African Medical Corps.
Capt. (Acting Major) William Drummond Miller, South African Medical Corps.
Lieut.-Col. Ernest Reinhold Rost, Indian Medical Service.
Major Eustace Lindsay Scott, M.C., Indian Medical Service.
Major Charles Edward Southon, M.B., Indian Medical Service.

To be Members of the said Most Excellent Order:—

Capt. William Herron Elliott, Royal Army Medical Corps (Special Reserve).
Capt. Geoffrey Balmano Fleming, Royal Army Medical Corps (Territorial Force).
Temp. Capt. Donald McIntyre, Royal Army Medical Corps.

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

St. James's Palace, S.W.,
November 18, 1918.

The King has been graciously pleased to give orders for the following appointment to the Most Excellent Order of the British Empire, for distinguished service in connexion with military operations in Egypt, to be dated June 3, 1918:—

To be Officer of the said Most Excellent Order:—

Major Edward Gibbon. M.B., Royal Army Medical Corps.

War Office,
November 22, 1918.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for distinguished services rendered during the course of the campaign.

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

DECORATIONS CONFERRED BY THE PRESIDENT OF THE FRENCH REPUBLIC.

LEGION D'HONNEUR.

Croix de Guerre.

Capt. (Acting Major) Richard Pitt Ballard, M.C., M.B., Royal Army Medical Corps (Special Reserve).
Temp. Capt. (Acting Major) Philip Carney, M.C., M.B., Royal Army Medical Corps.
Capt. (Acting Major) Daniel Dougal, M.C., M.D., Royal Army Medical Corps.
Temp. Capt. (Acting Major) James Angus Doull, M.D., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) Fitzgerald Gabbett Fitzgerald, D.S.O., Royal Army Medical Corps.
Lieut. William Aldridge Fraser, M.B., Royal Army Medical Corps (Special Reserve).
Temp. Capt. Lawrence Cameson, M.B., Royal Army Medical Corps.
Temp. Capt. James Franklin McLay, M.B., Royal Army Medical Corps.
Temp. Capt. Stanley Andrew Woolaston Munro, M.B., Royal Army Medical Corps.
Capt. (Acting Lieut.-Col.) Edgar Percival, D.S.O., M.C., M.B., Royal Army Medical Corps.
Major James Samuel Yeaman Rogers, D.S.O., M.B., Royal Army Medical Corps (attached Royal Highlanders).
Temp. Capt. Denis Jeffcott Stokes, M.B., Royal Army Medical Corps.
Temp. Capt. (Acting Lieut.-Col.) Robert Svensson, M.C., M.B., Royal Army Medical Corps.
Capt. (Acting Lieut.-Col.) Frank Worthington, D.S.O., M.B., Royal Army Medical Corps.
36490 Serjt.-Major Douglas James Dargie Belford, Royal Army Medical Corps (Wormit-on-Tay, Dundee).
82001 Pte. George Reginald Burgess, Royal Army Medical Corps (Bedford).
27563 Cpl. Arthur Fisher, M.M., Royal Army Medical Corps (Mansfield, Notts).
66131 Pte. James Flood, Royal Army Medical Corps (Mullingar).
79104 Pte. (Acting Qmr.-Serjt.) Frederick Harrison, Royal Army Medical Corps (Carlisle).
24793 Pte. Alan Bathe Johnson, Royal Army Medical Corps (Blackpool).
65380 Pte. Victor Benjamin Lee, Royal Army Medical Corps (Arnold, Notts).
44710 Pte. William Monaghan, Royal Army Medical Corps (Cowdenbeath).
63387 Pte. (Acting Lance-Cpl.) Joseph Phillips, Royal Army Medical Corps (Liverpool).
44740 Pte. William Smith, Royal Army Medical Corps (Sunderland).
103 Company Qmr.-Serjt. (Temp. Serjt.-Major) George Patrick Steer, Royal Army Medical Corps (South Farnborough).
65321 Cpl. John Strevens. Royal Army Medical Corps (Portslade, near Brighton).
30783 Pte. William Travis, Royal Army Medical Corps (Bootle).

Médaille Militaire.

76665 Pte. John Cresswell Armstrong, Royal Army Medical Corps (Low Fell, Co. Durham).
65750 Pte. (Acting Serjt.) Ernest George Waterman Mattick, Royal Army Medical Corps (Brighton).

India Office, Whitehall, S.W. 1,
November 26, 1918.

The following dispatch from His Excellency the Commander-in-Chief in India on the work of the Army in India and of the Civil Departments of the Government of India and of civilians in connexion with the War has been received from the Government of India:—

No. 17445—1.
Army Headquarters, India.
Simla,
August 20, 1918.

A list of those whose services have been of particular value, and whose assistance and work I desire to bring specially to notice, forms the subject of Appendix I of this dispatch.

Lieut.-Col. J. M. Crawford, O.B.E., M.B., Indian Medical Service.
Major G. I. Davys, M.D., Indian Medical Service.
Major H. Halliday, M.B., Indian Medical Service.

Lieut.-Col. T. Jackson, M.B., Indian Medical Service.
Col. W. E. Jennings, M.D., Indian Medical Service.
Major J. C. Kennedy, M.D., Royal Army Medical Corps.
Lieut.-Col. W. G. Liston, C.I.E., M.D., Indian Medical Service.
Col. W. Molesworth, C.I.E., M.B., Indian Medical Service.
Major G. F. Rugg, Royal Army Medical Corps.
Col. A. W. Sheen, M.D., Royal Army Medical Corps (T.F.).
Major A. E. Walter, Indian Medical Service.
Lieut.-Col. C. F. Wanhill, Royal Army Medical Corps.
Lieut.-Col. J. W. Watson, Indian Medical Service.

War Office,
December 2, 1918.

His Majesty the King has been graciously pleased to approve of the following awards to the undermentioned Officers in recognition of their gallantry and devotion to duty in the Field:—

DISTINGUISHED SERVICE ORDER.

Canadian Force.

Capt. David William McKechnie, No. 6 Field Ambulance, Canadian Army Medical Corps.
For conspicuous gallantry and devotion to duty. While preparing an advanced dressing station in a village it was subjected to an intense bombardment, but he remained at his post dressing the wounded, and refused to take underground cover.

Major Stanley Graham Ross, M.C., 6th Field Ambulance, Canadian Army Medical Corps.
For conspicuous gallantry and devotion to duty. On three successive days this Officer was in charge of collecting posts and advanced dressing stations. He accompanied the stretcher-bearers in the advance to see that proper touch was maintained. His coolness and disregard of danger under heavy fire had an excellent effect on the work of the bearer parties.

Col. Robert Mills Simpson, Canadian Army Medical Corps, Assistant Director Medical Service, 2nd Canadian Division.
For conspicuous gallantry and devotion to duty in establishing, often under heavy fire, his advanced dressing stations and collecting posts, and personally superintending the evacuation of the wounded. When a sudden attack resulted in the capture of a village, he went up under fire and personally dressed the wounds of his men on the field, evacuating all by the evening. His tireless work undoubtedly saved many lives.

SECOND BAR TO MILITARY CROSS.

Temp. Capt. (Acting Major) Robert Masson Grieg, M.C., M.B., 63rd Field Ambulance, Royal Army Medical Corps.
He displayed conspicuous gallantry and great devotion to duty in attending to the wounded and superintending their evacuation from advanced positions. To his admirable organization and self sacrificing endurance, working without rest or sleep, many wounded men owe their lives, and his coolness and courage when leading his stretcher-bearers under heavy fire were admirable. (M.C. gazetted November 25, 1916.) (1st Bar gazetted September 16, 1918.)

AWARDED A BAR TO MILITARY CROSS.

Capt. (Acting Major) Charles Stuart Peddie Black, M.C., 1/2nd (Low) Field Ambulance, Royal Army Medical Corps, Territorial Force.
For conspicuous gallantry and devotion to duty during an advance. Under heavy shell and machine-gun fire he reconnoitred the forward roads and brought up a tent sub-division and set up an advanced dressing station. By his energy and courage he was enabled to clear all wounded from the aid-posts and evacuate them to the main dressing station. (M.C. gazetted October 29, 1915.)

Capt. (Acting Major) William Murdoch, M.C., M.B., Royal Army Medical Corps (Special Reserve), attached 52nd Field Ambulance.
During three days' severe fighting he was untiring in his efforts, working night and day with his stretcher bearers, attending to wounded in forward positions and evacuating them rapidly through difficult country. He was severely wounded in the arm by direct machine-gun fire, but insisted on carrying on his duties until he received a direct order from the commanding officer to report to a dressing station. His courage under fire and great endurance were splendid examples to everyone. (M.C. gazetted January 1, 1918.)

Temp. Capt. Patrick Joseph O'Reilly, M.C., Royal Army Medical Corps, attached 7th Battalion East York Regiment.
For conspicuous gallantry and devotion to duty in attending to the wounded under heavy fire during several days' operations. He advanced with the leading troops in an attack, and brought in many wounded men from in front of the lines. He set an inspiring example of coolness and skill. (M.C. gazetted November 14, 1916.)

Temp. Capt. (Acting Major) John McLean Pinkerton, M.C., M.B., 13th Field Ambulance, Royal Army Medical Corps.

For conspicuous gallantry in charge of stretcher bearers. He went forward with some bearer squads to bring in wounded which bearers had been prevented from getting to by machine-gun fire. He ultimately succeeded in bringing in some of the wounded, though fired on every time he was observed. Throughout the operations he showed the greatest zeal and devotion to duty. He was finally severely wounded. (M.C. gazetted November 25, 1916.)

Temp. Capt. (Acting Major) William Kenneth Armstrong Richards, M.C., Royal Army Medical Corps, attached 55th Field Ambulance.

For conspicuous gallantry and devotion to duty. He followed up an attack under very heavy fire and organized and carried out the evacuation of the wounded during several days' operations with the greatest courage and skill. (M.C. gazetted June 4, 1917.)

Capt. Christopher Matheson Finlayson, E.C., Canadian Army Medical Corps, attached 20th Canadian Battalion 1st Canadian Ontario Reserve.

For conspicuous gallantry and devotion to duty. As medical officer of the battalion during an attack he did excellent work in attending to several wounded men under shell and machine-gun fire. His coolness and attention to duty, regardless of personal safety were an inspiration to all. (M.C. gazetted September 24, 1918.)

AWARDED THE MILITARY CROSS.

Temp. Capt. Ellis Campbell Bowden, Royal Army Medical Corps, attached 2nd Battalion, London Regiment.

He attended to wounded men under a very intense fire from machine guns, in daylight, and helped to carry many wounded into safety in full view of the enemy. His unceasing efforts and his self-sacrificing disregard of danger saved many lives, and were the admiration of all who saw him.

Temp Capt. (Acting Major) John Burke, 130th Field Ambulance, Royal Army Medical Corps.

During ten days' severe fighting he was unremitting in his devotion to duty, tending the wounded and selecting, often in the middle of the night, suitable places for his dressing stations. He displayed conspicuous courage and coolness under fire, and his initiative and endurance evoked the admiration of all who were with him.

Lieut. Finlay Cameron, Royal Army Medical Corps (Special Reserve), attached 14th Battalion, Welsh Regiment.

During many days' hard fighting his courage and devotion to duty were conspicuous. He was continually at work under heavy shell and machine-gun fire attending to the wounded and organizing their evacuation. He was wounded himself on one occasion, but remained at duty. His behaviour throughout was admirable.

Lieut. Henry Alexis Chodak, Royal Army Medical Corps (Special Reserve), attached 1/5thBattalion, London Regiment.

For conspicuous gallantry and devotion to duty. He was wounded during an attack but refused to withdraw and remained with the battalion for three more days attending to the wounded, often under heavy fire. He set a splendid example of determination.

Temp. Capt. Alfred Mackenzie Clark, M.B., Royal Army Medical Corps, attached 1st Battalion, Northumberland Fusiliers.

For conspicuous gallantry and devotion to duty. Hearing that there were several wounded men lying out that could not be collected until nightfall, owing to snipers and machine-gun fire, he went himself and dressed them in the shell holes where they lay. On this, as on other occasions, he showed a total disregard for his personal safety when the welfare of the wounded was at stake.

Capt. William James Dowling, M.B., Royal Army Medical Corps (Special Reserve), attached 3rd Battalion, M.G. Corps.

For conspicuous gallantry and devotion to duty. He tended and evacuated wounded of his own and other units under very heavy shell and machine-gun fire. Later, he did excellent work in charge of the bearer section of a field ambulance. By his zeal and fearless conduct he saved many lives.

Temp. Capt. Orie Elgin Finch, M.D., Royal Army Medical Corps, attached 2nd Battalion, King's Own Scottish Borderers.

For conspicuous gallantry and devotion to duty. He moved his aid post forward to close behind the front line, under very heavy machine-gun fire. Here he worked unceasingly in a trench for thirty-six hours bandaging and attending to wounded; and it was due to his fearless conduct and splendid energy that all the wounded were attended to in a short time.

Capt. (Acting Major) Stanley Rider Gibbs, 2/2nd (Wessex) Field Ambulance, Royal Army Medical Corps. Territorial Force.

For conspicuous gallantry and devotion to duty. He organized the finding and evacuation of one officer and four other ranks lying wounded in an advanced machine-gun post in front of our lines, and although the operation, which took several hours, was conducted under almost continous machine-gun fire, he recovered them all.

Temp. Capt. Basil Graves, Royal Army Medical Corps, attached 13th Battalion Royal Fusiliers.

For conspicuous gallantry during an attack. He dressed wounded in the open under difficult conditions, and frequently under machine-gun fire. Throughout the operation he encouraged the wounded by his cheerfulness and disregard of danger, and by his devotion to duty saved many lives.

Temp. Capt. William Hamilton, M.B., Royal Army Medical Corps, attached 223rd Battalion Royal Field Artillery.

For conspicuous gallantry during an advance. He remained at the gun positions throughout the operations. Under heavy shelling he attended to wounded in exposed positions, and was always cheerful under most trying circumstances. His courage and devotion to duty won him the admiration of all ranks.

Capt. (Acting Major) William James Hirst, M.B., 1st, attached 2/1st South Middlesex Field Ambulance, Royal Army Medical Corps, Territorial Force.

For conspicious gallantry and devotion to duty in organizing the evacuation of wounded from a village during an enemy attack. He remained behind when the enemy advanced into the village and assisted in removing all the wounded, refusing to leave the village until the last man had been brought in. He has at all times shown great coolness and disregard of danger under heavy fire.

Temp. Capt. Jeremiah Holland, M.B., Royal Army Medical Corps, attached 1st Battalion Cheshire Regiment.

For conspicuous gallantry and devotion to duty. Under very heavy machine-gun and rifle fire he collected and evacuated wounded from a ridge. He showed utter disregard for personal safety, and by his zeal and energy set a splendid example to those under him and saved many lives.

Temp. Lieut. Edward Digby Kinsey, Royal Army Medical Corps, attached 1st Battalion Bedfordshire Regiment.

For conspicuous gallantry and devotion to duty. He remained in the open for over an hour, when the battalion were incurring severe casualties from intense shelling, dressing the wounded and seeing that they were promptly carried into safety. His efforts resulted in the saving of many lives.

Temp. Capt. Alexander Chester Lambert, M.D., Royal Army Medical Corps, attached 8th Battalion Royal Lancashire Regiment.

For conspicuous gallantry and devotion to duty. He repeatedly established aid posts during an attack, and under very heavy shell and machine-gun fire attended and evacuated wounded belonging to his own and other units. When a shell struck his aid post, killing assistants and slightly wounding himself, he remained at duty and refused to go down. Throughout the operations his conduct was admirable.

Temp. Capt. Philip Whiteside MacLagan, M.B., Royal Army Medical Corps, attached 1st Battalion Herts Regiment.

For conspicuous gallantry and devotion to duty. He continued to bind up wounded on a road under shell fire. He also showed great ability in getting wounded evacuated from the aid post; and generally showed great coolness and disregard of danger under fire throughout the operations.

Capt. (Acting Major) Edward Bertram Marsh, M.B., Royal Army Medical Corps.

For gallantry and marked devotion to duty during an advance. He kept touch with the regimental medical officers' and bearer divisions under very adverse circumstances and heavy fire, and so co-ordinated the forward evacuation that the divisional front was cleared in the shortest possible time. His energy was remarkable throughout the operations.

Temp. Capt. Andrew Finlay Readdie, 21st Field Ambulance, Royal Army Medical Corps (Italy).

For conspicuous gallantry and devotion to duty. While supervising the evacuation of the wounded from the front line he heard that a medical officer in charge of stretcher bearers had been killed. He at once proceeded to the spot through heavy enemy barrage and took charge of the bearers, and it was due to his prompt action that no delay resulted. He has consistently done good work.

Temp. Capt. John Joseph Reynolds, Royal Army Medical Corps, attached 15th Battalion, Hampshire Regiment.

For conspicuous gallantry and devotion to duty. He formed an advanced regimental aid post on the side of the road thus shortening the stretcher bearers' journey. Eventually he was forced to evacuate this position owing to hostile fire. Later, he dressed and attended to all the casualties of three battalions, though partially gassed himself. By his untiring energy he undoubtedly saved many lives.

Temp. Capt. William Brockie Wilson, M.B., Royal Army Medical Corps, attached 1st Battalion, Devon Regiment.

For conspicuous gallantry and devotion to duty. He treated the wounded of his own and other battalions; this involved passing backwards and forwards over shell-swept areas. Later, he went

forward with his stretcher bearers and searched all the ground up to the front line. He showed splendid zeal and disregard of danger and set a fine example to those under him.

CANADIAN FORCE.

Capt. George Raymond Baby, No. 4 Field Ambulance, Canadian Army Medical Corps.

For conspicuous gallantry and devotion to duty in charge of a stretcher bearer section, which he bronght up immediately behind the infantry advance and collected the wounded. He was continuously exposed to every kind of hostile fire. His energy in searching for the wounded resulted in his area of the battlefield being thoroughly and quickly cleared.

Capt. (Acting Major) Frederick Clarence Clarke, 12th Field Ambulance, Canadian Army Medical Corps.

For conspicuous gallantry and devotion to duty. Under heavy shelling he collected four severely wounded men, dressed them, placed them under cover and remained with them until help arrived, when he got all four away safely. For three days of heavy fighting his cheerfulness and devotion to duty inspired all under him.

Capt. Joseph Culloden Eagar, Canadian Army Medical Corps, attached 78th Battalion, Manitoba Regiment.

For conspicuous gallantry and devotion to duty. Throughout the fighting this officer worked unceasingly ministering to the wounded, frequently under heavy shelling and machine-gun fire. He went without food or sleep, and when wounded refused to leave until his station was cleared.

Capt. Bellenden Seymour Hutchison, Canadian Army Medical Corps, attached 75th Canadian Battalion, 1st Central Ontario Regiment.

For conspicuous gallantry and devotion to duty. Before the battalion reached its jumping off position the enemy put down a heavy barrage and many casualties were sustained. This officer worked unceasingly in attending to and dressing the wounded under heavy fire in open ground. During the mopping up of a village he passed through the streets several times attending to the wounded. He also voluntarily dressed nearly 100 enemy wounded who had been left behind.

Capt. James Kilburn Mossman, No. 5 Field Ambulance, Canadian Army Medical Corps.

For conspicuous gallantry and tireless energy in the execution of his duty. This officer was in charge of a section of stretcher bearers and rapidly organized the evacuation of the wounded. He followed close on the attacking infantry waves, and regardless of his own safety attended to the wounded. His zeal and judgment were a great example to the men.

Capt. Finlay Munroe, Canadian Army Medical Corps, attached 52nd Canadian Battalion, Manitoba Regiment.

For conspicuous gallantry and devotion to duty in dressing and attending to wounded during a hostile barrage. This officer has always disregarded personal danger and has undoubtedly saved many lives on the battlefield.

Capt. Loudon Corsan Reid, 12th Field Ambulance, Canadian Army Medical Corps.

For conspicuous gallantry and devotion to duty. For several hours under heavy rifle and machine-gun fire he dressed and cleared wounded, and by his efforts saved many lives. He several times went forward to points of extreme danger to satisfy himself that all wounded had been cleared.

Capt. Albert Henderson Wallace, 13th Field Ambulance, Canadian Army Medical Corps.

For conspicuous gallantry and devotion to duty. While in charge of five stretcher squads he followed a battalion into action and established collecting posts for the wounded directly behind the battalion. His courage and initiative enabled the wounded to be got out rapidly thereby saving many lives.

Capt. William Charles Walsh, 13th Field Ambulance, Canadian Army Medical Corps.

For conspicuous gallantry and devotion to duty. With four squads of stretcher bearers he followed the battalion into action and established collecting posts a few hundred yards behind the front line. He dressed and evacuated wounded under heavy shell fire, working all day and night in the open until all were carried off the field. He behaved splendidly.

AUSTRALIAN IMPERIAL FORCE.

Capt. Lancelot John Hunter, Australian Army Medical Corps, attached 15th Battalion, Australian Infantry.

For conspicuous gallantry and devotion to duty. When the battalion was heavily shelled in a bivouac for two hours he attended to the wounded with utter disregard of danger. During an attack he followed closely behind the attacking troops and attended to the wounded under heavy fire. He set a splendid example of self-sacrifice.

Capt. Thomas Ross Jagger, Australian Army Medical Corps, attached 31st Battalion, Australian Infantry.

For conspicuous gallantry and devotion to duty. He carried on his work under heavy fire during two attacks and attended to the wounded of his own and other units with utter disregard of danger. He set a splendid example of courage and self-sacrifice.

Capt. (now Major) Sydney Michael O'Riordan, Australian Army Medical Corps, attached 18th Battalion, Australian Infantry.

For conspicuous gallantry and devotion to duty. During the later stages of an advance, when the infantry were under heavy fire, he established his aid post in an advanced position and dealt very rapidly with the casualties. His initiative and coolness under heavy fire were an inspiration to all who came in contact with him.

Capt. Frank Elliot Trenoweth True, Australian Army Medical Corps, attached 48th Battalion, Australian Infantry.

For conspicuous gallantry and devotion to duty. He moved forward with the assaulting troops under very heavy fire, established his aid post and organized his stretcher bearers and was the means of saving many of the wounded. He carried out his duties under heavy fire with great skill and courage.

Capt. Francis Louis Trinca, Australian Army Medical Corps, attached 2nd Australian Light Horse Regiment.

For conspicuous gallantry and devotion to duty. During an attack this officer, although suffering from fever, carried out his duties with great energy and total disregard of danger. Later, he accompanied the troops in a counter attack attending to casualties in the open under fire, and setting a fine example of endurance.

Capt. Paul Ernest Voss, Australian Army Medical Corps, attached 58th Battalion, Australian Infantry.

For conspicuous gallantry and devotion to duty. He worked at his aid post under heavy fire throughout two days' operations and attended to the wounded of two divisions. He set a fine example of courage throughout, and undoubtedly saved many lives.

December 5, 1918.

His Majesty the King has been graciously pleased to approve of the award of the Distinguished Conduct Medal to the undermentioned Non-commissioned Officers for gallantry and distinguished service in the Field:—

341263 Cpl. (Acting Serjt.) O. Dolan, M.M., 64th (W. Lancs.) Field Ambulance, Royal Army Medical Corps (T.F.) (St. Helens).

For conspicuous gallantry and devotion to duty. Seeing some infantry caught in a sudden enemy barrage, including gas, he rushed forward and carried in one man on his back from the gas cloud. Later, though suffering from the effects of gas, he led his bearers and cleared the remainder of the wounded. By his fine action and example he saved lives.

61886 Serjt. E. H. Foster, M.M., 91st Field Ambulance, Royal Army Medical Corps (Galway).

For conspicuous gallantry and devotion to duty in charge of a party of stretcher bearers during an attack on a village. He worked continuously from 3 a.m. to 9 p.m. clearing R.A.P.'s, and while supervising the various squads was constantly exposed to very heavy shell fire. Thanks to his untiring energy, about ninety severely wounded men on stretchers were safely and quickly removed, which undoubtedly saved the lives of many of them.

339017 Serjt. R. Pierce, M.M., 98th Field Ambulance, Royal Army Medical Corps (Seacombe).

For conspicuous gallantry and devotion to duty. He supervised the evacuation of wounded under heavy shelling at a bearer relay post. While assisting in lifting a stretcher case on to a wheeled carrier a shell wounded him. Nevertheless, he at once resumed his work under unabated shell fire, and secured the safe evacuation of several more cases, only seeking medical attention when the post was completely cleared. He behaved splendidly.

ISSUED WITH THE "GAZETTE OF INDIA," September 21, 1918.

The names of the undermentioned have been brought to the notice of the Government of India for valuable services rendered in India in connection with the war up to August 4, 1917, and where applicable an entry will be made in the record of services of the officers concerned:—

Capt. A. W. Byrne, Royal Army Medical Corps.
Major W. W. Browne, Royal Army Medical Corps.
Major-Gen. T. M. Corker, C.B., M.D., Army Medical Service (retired pay).
Capt. (Temp. Major) W. M. Dickson, Royal Army Medical Corps (Special Reserve).
Major A. T. Frost, M.B., Royal Army Medical Corps.
Major D. P. Johnstone, Royal Army Medical Corps.
Lieut.-Col. R. H. Lloyd, Royal Army Medical Corps.
Lieut.-Col. R. E. Molesworth, Royal Army Medical Corps (retired).
Lieut.-Col. H. W. H. O'Reilly, M.B., Royal Army Medical Corps.
Lieut.-Col. J. J. W. Prescott, D.S.O., Royal Army Medical Corps.
Capt. C. G. Sherlock, M.D., Royal Army Medical Corps.
Capt. W. A. Spong, M.B., Royal Army Medical Corps.
Capt. G. H. H. Waylen, Royal Army Medical Corps (T.F.).

ARMY MEDICAL SERVICE.

Col. Denis Moriarty O'Callaghan, C.M.G., is placed on retired pay, dated December 11, 1918.

ROYAL ARMY MEDICAL CORPS.

The undermentioned relinquish the acting rank of Lieutenant-Colonel on reposting:—
Dated August 26, 1918.—Capt. Sydney J. Higgins.
Dated October 10, 1918.—Major James T. McEntire, M.B.
The undermentioned to be acting Lieutenant-Colonels:—
Dated May 29, 1918.—Temp. Capt. (Acting Major) Herbert K. Wallace, M.D.
Dated September 26, 1918.—Major and Brevet Lieut.-Col. Dudley S. Skelton, D.S.O., whilst specially employed.
The undermentioned to be acting Lieutenant-Colonels whilst in command of a Medical Unit:—
Dated October 2, 1918.—Major Alexander W. Sampey.
Dated October 13, 1918.—Major John W. L. Scott, D.S.O.
The undermentioned Temporary Captains relinquish the acting rank of Major on reposting:—
Dated October 23, 1918.—George D. Laing, M.D.
Dated October 25, 1918.—Rupert S. Scott.
The undermentioned to be acting Majors:—
Dated April 5 to September 2, 1918.—Capt. John E. Hepper.
Dated October 14, 1918.—Capt. William P. Croker, M.B.
Major Ernest G. R. Lithgow is seconded for service with the Royal Air Force, dated October 1, 1918.
Capt. Ronald E. Todd, M.B., relinquishes the acting rank of Lieutenant-Colonel on reposting, dated December 6, 1918.
Capt. Gilbert G. Collet, M.B., relinquishes the acting rank of Lieutenant-Colonel, and reverts to the acting rank of Major (with pay and allowances of his substantive rank), dated September 28, 1918.
Capt. William P. MacArthur, D.S.O., M.D., F.R.C.P.I., to be acting Lieut.-Col. whilst specially employed, dated October 24, 1918.

THE MILITARY WIDOWS' FUND, BRITISH SERVICE, SIMLA.

We have received the following communication from Major F. A. H. Clarke, R.A.M.C.:—

"Now that the War has ended and reliefs for tour-expired officers of the Corps will doubtless soon be on their way to India, it seems an especially favourable moment to invite attention to the above-mentioned Fund, and to ask officers seriously to consider the advisability of their joining immediately on reaching the port of disembarkation.

"When bringing the benefits of the Fund to the notice of those already serving abroad, one is frequently told that it would have been entered earlier had the speaker known of it. To remove this disability all essential details are now given.

"The immediate object of the Fund, which was created in 1820, is to provide a sum of money to meet the immediate needs of the widow, and children if any, of officers of the British Service who die in India. Anyone familiar with the conditions of service in the tropics knows that, however healthy the general conditions may be, death—often comparatively sudden death—is standing at one's elbow, and one has often had to mourn the loss of friends during a tour of foreign service. How great, then, is the necessity that one's brother officers should not leave widows faced with the technical difficulties of the provision of immediate cash. An officer, approached on the subject of the Fund, once said: "Oh, there is no need for that; my wife could always go to the bank and get whatever balance there was standing to my credit if I died." He knew nothing of such things as probate and letters of administration. He was advised to call at the bank and ask whether his assumption was correct; the answer he received caused him to join the Fund forthwith.

"Now for details. First, as to cost. This is based upon the amount of pay received.

"The following table shows the subscription rate for an officer in receipt of pay and allowances of:—

	Rs. 750 and upwards	Between Rs. 400 and 750	Less than Rs. 400
Per month ..	Rs. 4 ..	Rs. 3 ..	Rs. 2
Per quarter ..	Rs. 12 ..	Rs. 9 ..	Rs. 6
Bachelors ..	Re. 1 per quarter		

"The widow of a subscriber is entitled to six months' maintenance allowance according to the following scale:—

"To the widow of a subscriber who paid a subscription—

On Rs. 750 and upwards ..	Rs. 600 a month ..	equals Rs. 3,600
On Rs. 400 and upwards ..	Rs. 500 a month ..	equals Rs. 3,000
On less than Rs. 400 ..	Rs. 400 ..	equals Rs. 2,400

and, in addition, will be granted a donation as follows:—

For herself	Rs. 1,500
For each child dependent on her above 12 and under 21 years ..	Rs. 500
For each child under 12 years	Rs. 300

"Thus, for example, a widow on the highest scale, with two children under 12, would get Rs. 3,600 plus Rs. 1,500 plus Rs. 600, total Rs. 5,700. Taking the value of the rupee as fifteen to the sovereign—the normal rate—this equals £380, a very useful sum, obtainable without formality at once. For this benefit the officer would have subscribed only Rs. 4, or 5s. 4d. per month—a sum which he would never have missed.

"Subscriptions are payable to the Secretary, Military Widows' Fund (British Service), Simla, India. An application to join the Fund should give the following particulars:—

Married or single.
Date of marriage.
Date of arrival in India on present tour of service.
Date of arrival in India as a married officer.
Date from which desirous of joining the Fund.
In receipt of pay and allowances of Rs. .... per month.

"Officers cannot subscribe for a higher rate than that fixed for the pay drawn by him. Subscriptions are preferably payable quarterly in advance by banker's order.

"An extract from the book of Regulations of the Fund would not be out of place. 'The Military Widows' Fund, British Service, has well fulfilled the intentions of its founders, and has saved many families from the humiliation of having to seek for charitable contributions.'

"A bound copy of the latest Regulations of the Fund obtainable at date, has been sent to the Commandant, Royal Army Medical College, Millbank, London.

"F. A. H. C."

ARMY MEDICAL OFFICERS' WIDOWS AND ORPHANS FUND.

NOTICE.

At a meeting of the Committee of this Society, held on January 16, 1919, it was resolved unanimously, on the advice of the Actuary to the Society, that the present extra war premium for new entrants into the Society be suspended until further notice.

This Fund provides annuities of £50 a year during widowhood to the widows of officers who have held permanent commissions in the Royal Army Medical Corps. In the event of the death of the widow this annuity is continued to the children of such marriage until the youngest attains the age of 21 years. It also continues for their benefit, up to the same age, if the widow re-marries. Furthermore, should the wife of the subscriber predecease him, it will be optional for him to continue the subscription he had been paying as a married member, in order to provide an annuity similar to the above for the children of the marriage, until the youngest shall have attained the age of 21 years.

Provision it also made whereby a part of the surplus at any quinquennial valuation may be applied for the benefit of members, or their widows, or orphan children. Thus, by the appropriations of surplus at the valuations of December 31, 1910 and 1915, the prospective widows of first-class married members on the books at those dates will receive, during this current quinquennium, £200 and £100 respectively at the death of their husbands, their annuities being also increased to the statutory limit of £52.

Unmarried members pay an annual subscription of £2, and on passing to the married class are allowed the equivalent of all past subscriptions in the unmarried class by way of reduction of their annual subscription in the married class.

Examples of the annual subscription for married members are:—

Husband's age	Wife's age	Annual subscription
25	20	£13 8 5
30	27	14 6 1
36	33	16 17 2
46	40	22 12 6
50	45	24 9 5

The Secretary will be glad to give any further information as to details.

3, *Homefield Road,*
Wimbledon, S.W. 19.
January 17, 1919.

J. T. Clapham, *Captain*.
Secretary.

OBITUARY.

Major Charles William Duggan, M.B., C.M., R.A.M.C., who lost his life on October 10, 1918, by the sinking of the R.M.S. "Leinster" by enemy action, was born at Edinburgh on October 14, 1866. He was the only son of the late William Nelson Duggan, M.D.Edin., Major, Army Medical Staff, and was educated at Daniel Stewart's and George Watson's Colleges. He graduated at Edinburgh University in 1887 and then proceeded to Vienna, subsequently studying at Prague and Paris. In 1889 he was Assistant to the late Professor Rutherford,

and engaged in original research with Professor Berry Haycraft, the results of their observations being published in the *Journal of Physiology.*

He joined the Royal Army Medical Corps in 1891 and married in 1895, Crystal, youngest daughter of the late W. H. Maund, Esq., and leaves three children. His foreign service included two tours on the West Coast of Africa: during the first he took part in the Expedition against the Sofas for which he obtained the medal and clasp. During his West Coast tours he did much good research work, and in 1897 an article by him was published by the Medico-Chirurgical Society, London, entitled "The Parasite of Malaria in the Fevers of Sierra Leone." Later he served at Gibraltar and in India and Burma. He was gazetted Major in 1903 and retired from the Service in 1909. On retirement he accepted a retired pay appointment in charge of the Military Hospital, Lincoln.

On the outbreak of war his work became very strenuous and when his hospital was enlarged to accommodate B.E.F. patients, he did much good service for the wounded soldiers by specializing in wound treatment.

He was "mentioned" for valuable services in the *Gazette* of February 24, 1917. His death occurred while obeying orders as he was returning from court martial duty at Cork when the "Leinster" was torpedoed by enemy action in the Irish Sea.

Always devoted to the welfare of others, the sufferings of our wounded touched him greatly and his sympathetic nature made him beloved by everyone. The following extract is taken from the Lincoln Depot Station Orders:—

"It is with regret that the Commanding Officer has to report the death of Major C. W. Duggan who was lost at sea on the R.M.S. 'Leinster' on October 10, whilst in the execution of his duty. Major Duggan had served with the depot for nine years and was loved and respected by all ranks. His loss is deeply mourned and the greatest sympathy is extended to his widow and children."

DEATH.

CLARK.—At Brighton, on December 14, 1914, Arthur, dearly loved only son of Colonel S. Frazer Clark, A.M.S., and Mrs. Clark, aged 21 years.

EXCHANGES, &c.

The charge for inserting Notices respecting Exchanges in the Royal Army Medical Corps is 5/- *for not more than five lines, which should be forwarded by Cheque or P.O.O., with the notice, to Messrs. G. STREET and CO., Ltd.,* 8, *Serle Street, London, W.C., not later than the* 22nd *of the month.*

A free issue of twenty-five reprints will be made to contributors of Original Communications, and of twenty-five excerpts of Lectures, Travels and Proceedings of the United Services Medical Society.

Any demand for reprints, additional to the above, or for excerpts, must be forwarded at the time of submission of the article for publication, and will be charged for at the following rates, and additional copies at proportionate rates:—

Number of Reprints	Number of Pages	Cost of Reprints	Cost of EXCERPTS*	Extra for Covers for Reprints			
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	16	0 13 3	0 5 10				
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Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are

inserted free of charge to subscribers and members of the Corps. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "Journal of the Royal Army Medical Corps," 324, Adastral House, Victoria Embankment, E.C. 4.

The following publications have been received:—

British: Tropical Diseases Bulletin, The Medical Journal of Australia, The Medical Review, Bulletin of Entomological Research, The Hospital, The Medical Press, Journal of the Department of Public Health, Hospital and Charitable Aid, The Journal of Tropical Medicine and Hygiene, The Practitioner, Guy's Hospital Gazette, The Royal Engineers' Journal.

Foreign: The Military Surgeon, Office International d'Hygiène Publique, Archives de Médecine et de Pharmacie Militaires, Surgery, Gynæcology and Obstetrics, The Journal of Infectious Diseases, Colonies et Marine, Bulletin of the Johns Hopkins Hospital, Leçons de Chirurgie de Guerre, Archives Médicales Belges, Bulletin de l'Institut Pasteur.

MANAGER'S NOTICES.

The Journal of the Royal Army Medical Corps is published monthly, six months constituting one volume, a volume commencing on 1st July and 1st January of each year.

The Annual Subscription is £1 (which includes postage), and should commence either on 1st July or 1st January; but if a subscriber wishes to commence at any other month he may do so by paying for the odd months between 1st July and 1st January at the rate of 1s. 8d. (one shilling and eightpence) per copy. (All subscriptions are payable in advance.)

Single copies can be obtained at the rate of 2s. per copy.

The Corps News is also issued separately from the Journal, and can be subscribed for at the rate of 2s. (two shillings) per annum, including postage. Subscriptions should commence from 1st July each year; but if intending subscribers wish to commence from any other month, they may do so by paying for the odd months at the rate of 2d. per copy. (All subscriptions are payable in advance.)

Officers of the Royal Army Medical Corps possessing Diplomas in Public Health, etc., are kindly requested to register their special qualifications at the War Office. Letters of complaint are frequently received from officers stating that their special qualifications have not been shown in the Distribution List which is published as a supplement to the Journal in April and October of each year. As, however, the particulars of this list are supplied from official sources, officers are reminded that unless the possession of Diplomas, etc., has been registered at the War Office, no entry of such qualifications can be recorded in the Distribution List.

Letters notifying change of address should be sent to the Hon. Manager, "Journal of the Royal Army Medical Corps," 25, Adastral House, Victoria Embankment, E.C. 4, and must reach there not later than the 20th of each month for the alteration to be made for the following month's issue.

It is requested that all Cheques or Postal Orders for Subscriptions to the Journal, Corps News, Reprints, etc., be crossed "Holt & Co.," and made payable to the "Hon. Manager, Journal R.A.M.C.," and not to any individual personally.

All communications for the Hon. Manager regarding subscriptions, etc., should be addressed to

The Hon. Manager,
"Journal of the Royal Army Medical Corps,"
25, Adastral House, Victoria Embankment, E.C.4.

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

FEBRUARY, 1919.

EXTRACTS FROM THE "LONDON GAZETTE."

War Office.
December 11, 1918.

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Military Medal to the undermentioned non-commissioned officers and men :—

ROYAL ARMY MEDICAL CORPS.

56157 Pte. W. Boyd, M.M., attached 1/2nd High. Field Ambulance (Territorial Force), (Honley). (M.M. gazetted December 17, 1917).

493353 Serjt. J. R. W. Budd, attached 2/1st (H.C.) Field Ambulance (Maidstone).

405380 Serjt. W. Gregson, 2/3rd (West Riding) Field Ambulance (Territorial Force), (Sheffield)

363008 Serjt. A. J. Hull, 7th Cavalry Field Ambulance (Mountain Ash).

303313 Cpl. J. F. Cowie, 2/1st (H.) Field Ambulance (Territorial Force), (Aberdeen).

881 Cpl. (Acting Serjt.) H. David, 18th Field Ambulance (Cardiff).

403297 Cpl. F. C. Langley, 2/3rd (West Riding) Field Ambulance (Territorial Force), (Bingley).

301118 Pte J. Abel, 2/1st (H.) Field Ambulance (Territorial Force), (Aberdeen).

403150 Pte. W. H. Allan, 2/2nd (West Riding) Field Ambulance (Territorial Force), (Leeds).

301080 Pte. (Acting Cpl.) R. Barbour, 2/1st (H.) Field Ambulance (Territorial Force), (Lossiemouth).

403853 Pte. T. Bourke, 2/2nd (West Riding) Field Ambulance (Territorial Force), (Leeds).

401255 Pte. J. Braddick, 2/1st (West Riding) Field Ambulance (Territorial Force), (Morley).

301304 Pte. A. A. Brechin, 2/1st (H.) Field Ambulance (Territorial Force), (Aberdeen).

320087 Pte. E. Clarke, 2/1st (H.) Field Ambulance (Territorial Force), (Edinburgh).

405300 Pte. C. Charlesworth, 2/3rd (West Riding) Field Ambulance (Territorial Force), (Rotherham).

305062 Pte. F. Crawford, 1/3rd (H.) Field Ambulance (Territorial Force), (Dundee).

41521 Pte. W. Crompton, attached 1/3rd (High.) Field Ambulance (Territorial Force).

457517 Pte. W. J. Dayment, 2/3rd (West Riding) Field Ambulance (Territorial Force), (Exeter).

77659 Pte. W. J. Davies, attached 1/3rd (High.) Field Ambulance (Pencader).

46990 Pte. (Acting Cpl.) A. A. Davies, attached 2/1st (High.) Field Ambulance (Territorial Force), (Liscard).

403533 Pte. N. E. Edwards, 2nd (West Riding) Field Ambulance (Territorial Force), Leeds.

405470 Pte. O. Evers, 2/3rd (West Riding) Field Ambulance (Territorial Force), (Whitewell, near Mansfield).

403640 Pte. A. Green, 2/2nd (West Riding) Field Ambulance (Territorial Force), (Castleford).

9918 Pte. F. W. Greenwood, attached 1/2nd (High.) Field Ambulance (Territorial Force), Stockton.

5302 Pte. J. W. Hayter, attached 1/2nd (High.) Field Ambulance (Territorial Force), (Ford, Devonport).

305162 Pte. D. A. Harris, attached 1/3rd (High.) Field Ambulance (Territorial Force), (Ayr).
303113 Pte. B. Jackson, 1/2nd (H.) Field Ambulance (Territorial Force), (Aberdeen).
75633 Pte. G. Jones, attached 1/2nd (High) Field Ambulance (Territorial Force), (Penycar).
7656 Pte. F. G. Jordan, attached 1/2nd (High.) Field Ambulance (Territorial Force), (Willesden).
301393 Pte. D. Lefevre, 2/1st (H.) Field Ambulance (Territorial Force), (Aberdeen).
303132 Pte. W. P. Leith, 2/1st (H.) Field Ambulance (Territorial Force), (Aberdeen).
51133 Pte. H. C. Locock, attached 1/2nd (High.) Field Ambulance (Territorial Force), (Bridport).
403343 Pte. W. Marsden, 2/2nd (West Riding) Field Ambulance (Territorial Force), (Armley).
322086 Pte. (Lance-Cpl.) J. McGowan, 1/3rd (H.) Field Ambulance (Territorial Force), Glasgow).
32439 Pte. (Lance-Cpl.) A. E. Rivers, attached 2/1st (High.) Field Ambulance (Territorial Force), (Liverpool).
79505 Pte. (Lance-Cpl.) J. Sayer, 2/3rd (West Riding) Field Ambulance (Territorial Force), Thornaby-on-Tees).
47867 Pte. (Lance-Cpl.) T. Scholes, 2/3rd (West Riding) Field Ambulance (Territorial Force), (Salford).
47810 Pte. (Acting Serjt.) H. C. Scorer, 141st Field Ambulance, (Parkstone).
405223 Pte. A. Smith, 2/3rd (West Riding) Field Ambulance (Territorial Force), (Sheffield).
11445 Pte. W. Smithson, 2/3rd (West Riding) Field Ambulance (Territorial Force), (Fenton).
303146 Pte. S. Simpson. 1/2nd (H.) Field Ambulance (Territorial Force), (Aberdeen).
301387 Pte. J. Stephen, 2/1st (H.) Field Ambulance (Territorial Force), (Aberdeen).
56962 Pte. L. J. Thomas, 2/2nd (West Riding) Field Ambulance (Territorial Force), (Haverfordwest).
405305 Pte. (Lance-Cpl.) T. Warner, 2/3rd (West Riding) Field Ambulance (Territorial Force), (Sheffield).
15753 Pte. (Lance-Cpl.) W. Whitmee, 18th Field Ambulance, (Cardiff).

Amendments.

The following are the correct descriptions of Non-commissioned Officers and Men whose names have appeared in the *London Gazette* for the award of the Military and Meritorious Service Medals :—

38887 Pte. J. H. Miller, M.M., 54th Field Ambulance, Royal Army Medical Corps. (Gazetted as J. Miller.)

65645 Cpl. T. R. Humphrey, Royal Army Medical Corps.

42231 Cpl. J. Janes, Royal Army Medical Corps. (Gazetted as James.)

The amendment in the *London Gazette*, dated September 29, 1918, should read :—

386009 Staff Serjt. (Acting Q.-Mr. Serjt.) H. Ord, Royal Army Medical Corps.

Deletions.

London Gazette, dated February 23, 1918 :—

44672 Pte. M. Gaffney, Royal Army Medical Corps. (Duplicate award.)

Distinguished Conduct Medal.

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Distinguished Conduct Medal to the undermentioned Non-Commissioned Officers and Man for gallantry and distinguished service in the field :—

439013 Serjt. E. V. Cann, M.M., Royal Army Medical Corps (Bristol).

For conspicuous gallantry and devotion to duty during a raid. He was in charge of a relay post in the front line which was blown in, burying a chaplain. He immediately went to his rescue and dragged him into a dug-out, finally carrying him under shell fire to a relay post in the rear. He behaved splendidly.

48124 Serjt. T. G. Hopkins, M.M., Royal Army Medical Corps (Treorchy).

Heavy shelling had caused severe casualties among artillery men and transport on a road. In spite of difficulty and great danger, he went to the aid of the wounded, extricated them from a tangle of kicking animals, and carried them to the comparative safety of shell-holes. He carried four wounded men one after another on his back. On a later date he brought back many wounded from an area heavily swept by machine gun fire. He was twice blown up by shells, but managed to reach the advanced dressing station and notified where the wounded were collected before he collapsed. His gallantry and self-sacrificing devotion to duty were peculiarly admirable.

46942 Pte. M. O'Hara, Royal Army Medical Corps (Heywood).

For conspicuous gallantry and devotion to duty. When he and three other bearers were bringing in a wounded man to the advanced dressing station a shell burst and wounded two of the bearers and killed the third. He at once carried the wounded man into shelter, and then went under heavy fire and collected three more bearers and brought all wounded back to the advanced dressing station. He behaved splendidly.

War Office,
December 30, 1918.

The following is a continuation of Sir D. Haig's dispatch, November 8, 1918, submitting names deserving of special mention :—

ARMY MEDICAL SERVICE.

Staff.

Lieut.-Col. (Temp. Col.) H. P. W. Barrow, C.M.G., D.S.O., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) W. Bennett, D.S.O., M.B., Royal Army Medical Corps.
Col. E. W. Bliss, C.M.G., D.S.O.
Capt. and Brevet-Major (Acting Major) L. G. Bourdillon, D.S.O., M.C., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) G. W. Brazier-Creagh, C.B., C.M.G., R.P.
Lieut.-Col. (Temp. Col.) B. B. Burke, D.S.O.
Major-Gen. (Temp. Lieut.-Gen.) C. H. Burtchaell, C.B., C.M.G., M.B.
Major-Gen. H. Carr, C.B., M.D.
Capt. (Acting-Major) S. J. Clegg, M.B., Royal Army Medical Corps (Territorial Force).
Lieut.-Col. (Temp. Col.) H. Collinson, C.M.G., D.S.O., M.B., F.R.C.S., Royal Army Medical Corps (Territorial Force).
Capt. (Acting Major) W. H. Davison, M.B., Royal Army Medical Corps (Territorial Force).
Capt. (Acting Major) T. I. Dun, M.C., M.B., Royal Army Medical Corps.
Capt. and Brevet-Major (Temp. Major) G. W. Ellis, Royal Army Medical Corps (Territorial Force).
Lieut.-Col. (Temp. Col.) O. W. A. Elsner, D.S.O.
Lieut.-Col. (Temp. Col.) H. B. Fawcus, C.M.G., D.S.O., M.B.
Lieut.-Col. (Temp. Col.) T. Fraser, D.S.O., M.B., Royal Army Medical Corps (Territorial Force).
Lieut.-Col. (Temp. Col.) R. S. H. Fuhr, C.M.G., D.S.O., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) J. S. Gallie, C.M.G., D.S.O.
Major (Temp. Col.) G. E. Gask, D.S.O., F.R.C.S.
Capt. (Acting Major) G. E. P. Gibbons, Royal Army Medical Corps (Special Reserve).
Col. H. W. Grattan, D.S.O.
Temp. Capt. A. H. Creg, M.B., F.R.C.S., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) J. A. Hartigan, C.M.G., D.S.O., M.B., Royal Army Medical Corps.
Lieut.-Col. (Acting Col.) H. Herrick, D.S.O.
Lieut.-Col. (Acting Col.) H. Hewetson, D.S.O., Royal Army Medical Corps.
Col. (Temp. Major-Gen.) S. Hickson, C.B.
Major (Temp. Lieut.-Col.) F. D. G. Howell, D.S.O., M.C.
Col. W. E. Hudleston, C.M.G., D.S.O.
Col. Sir J. M. Irwin (Temp. Major-Gen.) K.C.M.G., C.B.
Col. T. P. Jones, C.M.G., M.B.
Lieut.-Col. (Temp. Col.) L. N. Lloyd, C.M.G., D.S.O.
Lieut.-Col. (Temp. Col.) A. J. MacDougall, M.B.
Capt. (Acting Major) E. B. Marsh, M.B.
Lieut.-Col. (Temp. Col.) H. G. Martin.
Lieut. Col. (Temp. Col.) F. McLennan, M.B., Royal Army Medical Corps.
Temp. Capt. (Acting Major) L. Meakin.
Col. (Temp. Major-Gen.) S. G. Moores, M.B., C.M.G.
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Capt. (Acting Major) B. A. Odlum, Royal Army Medical Corps.
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Col. G. St.C. Thom, C.B., C.M.G., M.B.
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Col. H. S. Thurston, C.B., C.M.G.
Capt. (Temp. Major) J. Walker, M.C., M.B., Royal Army Medical Corps (Special Reserve).
Capt. (Acting Major) W. L. Webster, M.B.
Lieut.-Col. (Temp. Col.) B. F. Wingate, D.S.O., Royal Army Medical Corps.
Capt. (Temp. Major) A. R. Wright, D.S.O., M.B.
Col. C. A. Young, C.M.G.

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Temp. Col. A. Fullerton, C.M.G., M.D., F.R.C.S.I.
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Temp. Lieut.-Col. G. M. Holmes, C.M.G., M.D.
Temp. Col. W. E. Hume, M.B., F.R.C.S.
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Temp. Col. Sir A. E. Wright, C.B., M.D., F.R.C.S.I., F.R.S.

ROYAL ARMY MEDICAL CORPS.

Lieut.-Col. W. J. P. Adye-Curran.
Temp. Capt. (Acting Major) J. Alexander, M.B., 53rd Field Ambulance.
Capt. (Acting Major) J. A. Andrews, M.C., M.B., 4th Field Ambulance.
Temp. Capt. (Acting Major) W. B. G. Angus, M.C., M.B., 62nd Casualty Clearing Station.
Temp. Capt. (Acting Major) J. B. Arkle, M.B.
Temp. Lieut.-Col. J. L. Birley, M.B.
Temp. Capt. (Acting Major) A. J. Blake, M.C., 88th Field Ambulance.
Capt. and Brevet Major (Acting Lieut.-Col.) H. H. Blake, M.B., No. 13 Convalescent Depot.
Temp. Capt. W. H. Blakemore.
Temp. Capt. (Acting Major) L. R. Broster, M.B., attached H.Q., Tank Corps.
Temp. Capt. (Acting Lieut.-Col.) L. G. Brown, M.C., No. 15 Convalescent Depot.
Major and Brevet Lieut.-Col. (Acting Lieut.-Col.) C. G. Browne, D.S.O., No. 14 Convalescent Depot.
Major (Temp. Lieut.-Col.) R. A. Bryden, D.S.O., 52nd Field Ambulance.
Qmr. and Major E. J. Buckley, O.B.E.
Temp. Hon. Lieut.-Col. H. Cabot, attached No. 22 (Harvard) General Hospital.
Capt. (Acting Major) N. Cantlie, M.C., M.B., attached Headquarters, 6th Division.
Major (Acting Lieut.-Col.) J. C. G. Carmichael, M.B.
Temp. Capt. H. H. Carter, M.B., attached 12th Brigade, Royal Garrison Artillery.
Capt. (Acting Lieut.-Col.) F. Casement, D.S.O., M.B., 149th Field Ambulance.
Temp. Capt. (Acting Major) R. Charles, F.R.C.S.I.
Temp. Capt. T. Clapperton, M B., 141st Field Ambulance.
Temp. Capt. E. A. Coward), M.D.
Temp. Capt. R. L. Crabb, M.D., No. 13, Convalescent Depot.
Temp. Capt. R. Crothers, F.R.C.S., 30th M.A.C.
Temp. Lieut.-Col. J. Dalyrymple, O.B.E., commanding No. 3 Convalescent Depot.
Temp. Capt. F. Dillon, M.B
Temp. Capt. (Acting Major) W. S. Danks, 97th Field Ambulance.
Major (Temp. Lieut.-Col.) H. A. Davidson, D.S.O., M.B., 75th Field Ambulance.
Temp. Major R. Dick, No. 32 Stationary Hospital.
Temp. Major W. S. Dickie, F.R.C.S.
Qmr. and Capt. R. N. Downing, No. 6 General Hospital.
Major (Temp. Hon. Lieut.-Col.) G, Dreyer, attached Royal Air Force.
Major (Acting Lieut.-Col.) C. T. Edmunds, 57th Field Ambulance.
Temp. Capt. R. F. Eminson, D.S.O., M.B., attached 8th Battalion N. Staffordshire Regiment.
Temp. Capt. J. E. English, M.B., No. 11 Convalescent Depot.
Temp. Qmr. and Capt. H. L. Etherington-Smith, No. 1 Red Cross Hospital.
Capt. (Acting Lieut.-Col.) T. S. Eves, D.S.O., M.B., 43rd Field Ambulance.
Lieut.-Col. (Acting Col.) F. G. Fitzgerald, D.S.O., attached 45th Casualty Clearing Station.
Capt. W. Foot, M.C., M.B., No. 3 Convalescent Depot.
Major (Acting Lieut.-Col.) W. H. Forsyth, M.B., 38th Field Ambulance.
Major J. R. Foster, Commanding 42nd M.A.C.
Temp. Major T. M. Frood, No. 2 Native Lab. General Hospital.
Temp. Capt. D. S. Graham, 44th Field Ambulance.

Temp. Major (Acting Lieut.-Col.) G. D. Gray, M.D., No. 3 Native Lab. General Hospital.
Temp. Capt. H. A. Grierson, M.B., attached 251st (Northumbrian) Brigade, Royal Field Artillery (T.F.).
Capt. J. H. Gurley.
Temp. Hon. Capt. F. Hall, M.B., attached St. John Ambulance Brigade Hospital.
Major (Temp. Lieut.-Col.) P. J. Hanafin, D.S.O., 13th Field Ambulance.
Temp. Capt. C. G. Harmer, M.D., Detention Hospital, Paris.
Capt. (Acting Major) W. C. Hartgill, M.C., 55th Field Ambulance.
Major (Temp. Lieut.-Col.) T. E. Harty, D.S.O., 28th Field Ambulance.
Temp. Qmr. and Capt. R. Harvey, No. 1 Stationary Hospital.
Temp. Capt. (Acting Major) J. H. Hebb, M.B., 107th Field Ambulance.
Capt. (Acting Lieut.-Col.) V. Helm, M.C., 42nd Field Ambulance.
Temp. Capt. W. J. Henry, M.B., attached 11th Battalion Rifle Brigade.
Temp. Capt. S. P, Hodkinson, M. B.. attached H.Q., 9th Brigade, Royal Garrison Artillery.
Temp. Hon. Major T. Houston, M.D.. St. John Ambulance Brigade Hospital.
Capt. (Acting Lieut.-Col.) I. R. Hudleston, 136th Field Ambulance.
Temp. Capt. J. B. Hunter, M.B., Scottish Red Cross Mobile Unit.
Temp. Capt. (Acting Major) R. C. Irvine, M.B., attached 63rd (2/2nd W. Lanc.) Field Ambulance, Royal Army Medical Corps (T.F.).
Temp. Capt. T. B. Johnstone, "E" Depot, Etaples.
Temp. Capt. (Acting Major) N. McD., Keith, attached 6th Casualty Clearing Station.
Major (Temp. Lieut.-Col.) H. B. Kelly, D.S.O., M.B., 77th Field Ambulance.
Temp. Capt. M. J. Kelly, attached Headquarters 46th Brigade, Royal Field Artillery.
Temp. Capt. L. Kilroe, M.D., Standing Medical Board, Etaples.
Temp. Capt. G. B. King, No. 10 Convalescent Depot.
Temp. Capt. (Acting Major) A. E. Knight, M.C., M.B.
Temp. Capt. G. D. Laing, M.D., 20th Field Ambulance, attached School of Instruction.
Temp. Capt. R. D. Laurie, M.B.
Temp. Capt. L. R. Lempriere, M.B., attached Headquarters 1st Army.
Temp. Capt. F. R. Lowe, M.B., No. 15 Ambulance Train.
Temp. Major S. G. Luker, M.D., F.R.C.S., 39th Stationary Hospital.
Temp. Capt. J. Lumb, M.B., 4th Sanitary Section, attached 2nd Cavalry Division.
Temp. Capt. (Acting Major) R. B. Macfie, M.B., F.R.C.S., 55th Casualty Clearing Station.
Capt. K. P. Mackenzie, M.B., No. 5 Convalescent Depot.
Temp. Capt. (Acting Lieut.-Col.) K. W. Mackenzie, D.S.O., M.C., M.B., 6th Field Ambulance.
Temp. Capt. Malloch, M.B., attached Headquarters 150th Brigade, Royal Field Ambulance.
Temp. Major (Acting Lieut.-Col.) E. H. Marshall, D.S.O., No 2 Convalescent Depot.
Temp. Capt. A. E. S. Martin, F.R.C.S.I., 32nd Casualty Clearing Station.
Temp. Capt. (Acting Major) A. Massey, M.B., 111th Field Ambulance.
Temp. Capt. (Acting Major) R. Massie, F.R C.S., No. 47th General Hospital.
Major (Temp. Lieut.-Col.) F. A. McCammon, M.C., M.B., No. 11 Convalescent Depot.
Temp. Capt. J. McDonnell, M.C., No. 10 Convalescent Depot.
Temp. Capt. J. P. McCreehin, M.B.. attached 4th Battalion Royal Fusiliers.
Temp. Capt. J. B. P. McLaren, M.B., attached 10/11th Battalion H.L.I.
Temp. Capt. J. W. McLeod, M.B., 8th Mobile Bacteriological Laboratory.
Temp. Capt. K. C. Middlemiss, M.B., attached 231st Field Ambulance.
Temp. Capt. E. T. C. Milligan, M.D.
Temp. Capt. W. Moodie, M.D., 17th Mobile Bacteriological Laboratory.
Temp. Capt. (Acting Lieut.-Col.) H. Moore, D.S.O., M.C., 16th Field Ambulance (died of wounds).
Temp. Capt. J. Morris.
Temp. Capt. (Acting Major) W. G. Mumford, M.B., F.R.C.S., attached 42nd Casualty Clearing Station.
Major (Acting Lieut.-Col.) C. D. Myles, O.B.E., M.B., No. 10 Convalescent Depot.
Temp. Capt. G. E. E. Nicholls, M.B., attached 113th Field Ambulance.
Qmr. and Capt. E. O'Hara, 10th Field Ambulance.
Major (Acting Lieut.-Col.) E. M. O'Neill, D.S.O., M.B., 3rd Field Ambulance.
Qmr. and Capt. (Acting Major) J. T. Packard, attached No. 12 Adv. Depot of Medical Stores.
Temp. Capt. (Acting Major) M. P. Paton, M.C., M.B.
Major (Temp. Lieut. Col.) H. S. Peeke, No. 1 Red Cross Hospital.
Temp. Capt. E. I. P. Pellew, 37th M.A.C.
Temp. Qmr. and Lieut. W. E. Perritt, 109th Field Ambulance.
Capt. H. M. J. Perry, No. 14 Stationary Hospital.
Temp. Capt. H. J. Pickering, 15th Field Ambulance.
Temp. Capt. A. E. Pinniger, M.B.
Capt. (Acting Lieut.-Col.) L. T. Poole, D.S.O., M.C., M.B., 141st Field Ambulance.
Temp. Capt. A. V. Poyser, M.B., No. 6 Convalescent Depot.
Capt. (Acting Lieut -Col.) R. B. Price, D.S.O., M.B.
Temp. Qmr. and Lieut. G. Read, 93rd Field Ambulance.

Temp. Capt. A. C. Reid, M.D., attached 1/3rd N. Mid. Field Ambulance.
Temp. Capt. (Acting Major) A. Richmond, M C., M.B., 19th Field Ambulance.
Major M. B. H. Ritchie, D.S.O., M.B.
Temp. Capt. (Acting Major) T. C. Ritchie, M.D., 30th Casualty Clearing Station.
Temp. Capt. (Acting Major) J. E. H. Roberts, M.B., F.R.C.S., 41st Casualty Clearing Station.
Major (Acting Lieut.-Col.) T. T. H. Robinson, M.B., 5th Field Ambulance.
Temp. Capt. (Acting Major) R. B. Roe.
Temp. Capt. H. A. Ronn, M.B., attached 3rd Dragoon Guards.
Temp. Capt. (Acting Major) S. J. Rowntree, 29th Casualty Clearing Station.
Temp. Capt. S. H. Scott, No. 13 Convalescent Depot.
Capt. (Acting Lieut.-Col.) T. H. Scott, D.S.O., M.C., M.B., 14th Field Ambulance.
Temp. Capt. (Acting Major) E. J. Selby, attached 24th Division.
Temp. Capt. W. F. Shanks, M.B., attached 30th Brigade, Royal Garrison Artillery.
Lieut. (Temp. Capt.) F. R. S. Shaw, M.C., M.B., No. 15 Convalescent Depot.
Temp. Capt. (Acting Lieut.-Col.) L. D. Shaw, D.S.O., M.B., 9th Field Ambulance.
Temp. Capt. F. N. Stewart, D.S.O., M.C., M.D., attached 15th Battalion Cheshire Regiment.
Temp. Capt. J. L. Stewart, D.S.O., M.C., M.B., attached 1st Battalion Gordon Highlanders.
Capt. (Acting Lieut.-Col.) C. H. Stringer, D.S.O., 6th Cavalry Field Ambulance.
Temp. Capt. C. E. Sundell, M.D., No. 2 Stationary Hospital.
Temp. Capt. (Acting Lieut.-Col.) R. Svensson, M.C., M.B., 102nd Field Ambulance.
Major (Acting Lieut.-Col.) R. G. H. Tate, M.D., No. 72 General Hospital.
Capt. E. S. Taylor, M.B., 54th Casualty Clearing Station.
Capt. (Acting Lieut.-Col.) G. P. Taylor, D.S.O., M.C., M.B., 54th Field Ambulance.
Temp. Capt. E. M. Townsend, attached Royal Engineers.
Temp. Lieut.-Col. C. J. Trimble, C.B., C.M.G., V.D. (Lieut.-Col. and Hon. Col. T.F. Reserve), attached St. John Ambulance Brigade Hospital.
Temp. Qmr. and Lieut. C. F. Tyson, 105th Field Ambulance.
Major (Acting Lieut.-Col.) T. B. Unwin, M.B., No 39 Stationary Hospital.
Temp. Qmr. and Capt. J. Varley, 129th Field Ambulance.
Temp. Capt. (Acting) Major R. J. Vernon, M.B., 113th Field Ambulance.
Capt. and Brevet Major A. Walker, D.S.O., attached 9th Battalion Cheshire Regiment.
Temp. Capt. K. M. Walker, M.B., F.R.C.S.
Temp. Capt. H. H. Whaite, M.B.
Major C. F. White, M.B., No 29 General Hospital.
Temp. Capt. R. W. Willcocks, M.B., attached Headquarters, 155th Brigade, R.F.A.
Temp. Capt. R. L. Williams, D.S.O., M.C., attached 2nd Battalion, S. Staffs Regiment.
Temp. Capt. (Acting Major) H. G. Willis, D.S.O., M.C., M.B., 8th Field Ambulance.
Temp. Capt. (Acting Major) H. B. Wilson, M.D., 5th Casualty Clearing Station.
Temp. Hon. Capt. W. Wilson, M.B., attached St. John Ambulance Brigade Hospital.
Temp. Capt. (Acting Major) F. B. Winfield.
Temp. Capt. R. S. Woods, M.D., No. 14 Convalescent Depot.
Temp. Hon. Lieut. H. W., Woodward, attached No. 24 General Hospital.
Capt. (Acting Lieut.-Col.) F. Worthington, D.S.O., M.B., 45th Field Ambulance.
8720 Serjt. F. Abel, 53rd Field Ambulance, attached 218th Employment Company, Labour Corps.
1094 Staff-Serjt. (Acting Serjt.-Major) H. B. Alloway.
55167 Pte. (Acting Serjt.) H. H. Amos, No. 33 Advance Depot of Medical Stores.
36203 Staff-Serjt. H. Anthony, 97th Field Ambulance.
30791 Serjt. S. J. Bailey, No. 51 General Hospital.
18380 Staff-Serjt. E. Bodger.
63938 Pte. (Acting Cpl.) G. S. Bradley, attached Headquarters, 35th Division.
39407 Cpl. C. H. Brown, attached Headquarters, 3rd Army.
79412 Pte, (Acting Lance-Cpl.) P. C. Bullock, 3rd Mobile X-ray Unit.
36921 Cpl. (Acting Serjt.) E. A. Chilton, 49th Field Ambulance.
65442 Serjt. J. Coleman, No. 16 Advance Depot of Medical Stores.
5430 Cpl. (Acting Staff-Serjt.) S. Dickson, attached Headquarters, 4th Army.
78781 Pte. H. W. Dove, 107th Field Ambulance.
74864 Pte. (Acting Serjt.) A. Elbro, 11th Field Ambulance.
7660 Pte. (Acting Serjt.) J. H. Fisher, No. 6 Stationary Hospital.
61814 Qmr.-Serjt. F. Found, attached Headquarters, 74th Division.
30266 Serjt. J. O. Fraser, 56th Field Ambulance.
73698 Pte. H. A. Freestone, 51st Field Ambulance.
72989 Pte. S. T. Furnell, 103rd Field Ambulance.
43122 Pte. (Acting Lance-Cpl.) A. E. Green, 139th Field Ambulance.
69244 Pte. J. F. Gregson, 73rd Field Ambulance.
36455 Qmr.-Serjt. W. A. Griffiths, 57th Field Ambulance.
36371 Pte. H. J. Guy, 2nd Cavalry Field Ambulance
66536 Serjt. E. M. Ham, 99th Field Ambulance.
47075 Cpl. R. Hedley, No. 7 Ambulance Train.

32828 Cpl. (Acting Staff-Serjt.) H. Keatley.
30735 Pte. A. R. Knight, 61st Field Ambulance.
41694 Cpl. (Acting Staff-Serjt.) D. Lyons, 76th Field Ambulance.
19547 Staff-Serjt. W. A. Mansell, 108th Field Ambulance.
60658 Qmr.-Serjt. F. L. Marshall, 94th Field Ambulance.
56697 Staff-Serjt. (Acting Qmr.-Serjt.) E. C. Martin, 36th Field Ambulance.
12656 Cpl. (Acting Serjt.) J. McKeown, 4th Field Ambulance.
41841 Serjt. A. E. McLaughlan, 13th Field Ambulance.
38892 Staff-Serjt. (Acting Qmr.-Serjt.) F. Mitchell, 55th Field Ambulance.
18948 Qmr.-Serjt. (Temp. Serjt.-Major) E. Moore, 33rd Field Ambulance.
6162 Cpl. H. Morris.
36425 Pte. (Acting Serjt.) E. Powell, 38th Field Ambulance.
15619 Sarjt.-Major E. Preston, 4th Casualty Clearing Station.
72121 Pte. (Acting Cpl.) F. V. V. Purser, attached Headquarters, 39th Division.
2435 Cpl. (Acting Serjt.) F. Read, 16th Sanitary Squad.
90388 Pte. J. Round, 60th Field Ambulance.
11594 Serjt. C. Ryan, No. 35 General Hospital.
40858 Serjt. H. J. Standerwick, 50th Field Ambulance.
545395 Cpl. (Acting Staff-Serjt.) M. D. Stewart, attached Independent Force, R.A.F.
32669 Serjt. G. N. Strachan, attached Headquarters, 2nd Division.
5390 Cpl. (Acting Serjt.) D. C. Tait, 11th Field Ambulance.
7732 Pte. L. Thompson, 75th Ambulance.
52160 Cpl. (Acting Qmr.-Serjt.) A. S. Ward, attached Headquarters, 21st Division.
1014 Pte. (Acting Cpl.) W. Weber, attached Headquarters, 6th Division.
653 Pte. (Acting Serjt.) J. Welsh, 11th Field Ambulance.
48040 Pte. J. Williams, 129th Field Ambulance.
58206 Pte. (Acting Cpl.) A. Wilson, attached 3rd Division.
31816 Serjt. (Acting Qmr.-Serjt.) B. Wilson, 29th Field Ambulance.
47064 Serjt. H. A. Wright, 101st Field Ambulance.
30981 Staff-Serjt. A. G. Wyatt, 46th Field Ambulance.
46875 Serjt.-Major G. O. Yeatman, 97th Field Ambulance.

ROYAL ARMY MEDICAL CORPS (SPECIAL RESERVE).

Capt. (Acting Major) R. P. Ballard, M.C., M.B., 46th Field Ambulance.
Capt. (Acting Major) W. Barclay, M.C., M.B., 51st Field Ambulance.
Capt. (Acting Major) J. H. Bayley, M.C., 76th Field Ambulance.
Major W. H. G. H. Best.
Capt. A. D. Child, M.B.
Capt. W. Darling, M.C., M.B., F.R.C.S., attached R.A.F.
Capt. (Acting Major) D. Dougal, M.C., M.D.
Capt. C. Gamble, M.B.
Capt. (Acting Major) C. E. H. Gater, attached 64th Field Ambulance, Royal Army Medical Corps (Territorial Force).
Capt. (Acting Major) B. Goldsmith, 23rd Casualty Clearing Station.
Capt. (Acting Lieut.-Col.) C. J. A. Griffin, M.B., 5th Cavalry Field Ambulance.
Capt. G. G. Jack, attached 2/2nd West Riding Field Ambulance, Royal Army Medical Corps (Territorial Force).
Capt. A. R. Laurie, M.B., attached 6th Battalion, Yorkshire Regiment.
Capt. (Acting Major) G. Marshall, M.B., 10th Casualty Clearing Station.
Major (Acting Lieut.-Col.) S. G. McAllum, M.D., 140th Field Ambulance.
Capt. (Acting Lieut.-Col.) W. McK. H. McCullagh, D.S.O., M.C., M.B., 137th Field Ambulance.
Capt. (Acting Major) W. C. B. Meyer, M.B., 17th Casualty Clearing Station.
Capt. (Acting Lieut.-Col.) K. D. Murchison, D.S.O., M.B., 56th Field Ambulance.
Capt. (Acting Lieut.-Col.) C. M. Page, M.B., F.R.C.S., 90th Field Ambulance.
Capt. (Acting Lieut.-Col.) A. T. Pitts, D.S.O., 4th Cavalry Field Ambulance.
Capt. (Acting Major) H. D. Rollinson, M.D., 11th Casualty Clearing Station.
Capt. E. S. Rowbotham, 2nd Cavalry Field Ambulance.
Capt. (Acting Major) A. L. Shearwood, M.B., 33rd Field Ambulance.
Capt. (Acting Major) J. C. Spence, M.C., M.B., 34th Field Ambulance.
Capt. (Acting Major) L. W. C. Taylor, M.B., 12th Casualty Clearing Station.
Capt. (Acting Lieut.-Col.) W. Tyrrell, D.S.O., M.B., M.C., 75th Field Ambulance.
Capt. (Acting Major) W. W. Wagstaffe, M.B., F.R.C.S., 23rd Casualty Clearing Station.
Capt. (Acting Lieut.-Col.) J. H. Ward, D.S.O., M.C., M.B., 1st Cavalry Field Ambulance.
Capt. (Acting Major) C. J. B. Way, M.C., 50th Field Ambulance.
Capt. C. O. J. Young, M.C., M.B., No 12 Stationary Hospital.

ROYAL ARMY MEDICAL CORPS (TERRITORIAL FORCE).

Capt. (Temp. Major) H. C. Adams, 2/2nd Wessex Field Ambulance.
Capt. (Acting Lieut.-Col.) E. Alderson, D.S.O., 1/3rd Wessex Field Ambulance.

Capt. (Temp. Lieut.-Col.) J. Barkley, 2/3rd G. C. Field Ambulance.
Capt. (Acting Major) C. B. Baxter, M.B., F.R.C.S.
Capt. (Acting Lieut.-Col.) W. Blackwood, D.S.O., M.B., 2/1st Wessex Field Ambulance.
Major H. D'A. Blumberg, T.D.
Qmr. and Capt. C. W. Braithwaite, 2/2nd Northumberland Field Ambulance.
Capt. (Acting Major) W. Briggs, M.B., 64th Casualty Clearing Station.
Qmr. and Capt. A. H. Brindley, 61st Casualty Clearing Station.
Capt. A. S. Bruxaud.
Capt. (Acting Lieut.-Col.) R. Burgess, M.C., 24th Field Ambulance.
Capt. (Acting Major) H. Burrows, M.B., F.R.C.S., No. 20 General Hospital.
Capt. J. W. Burton, M.B., 1/1st Low. Field Ambulance.
Major (Acting Lieut.-Col.) A. Callam, M.B., 1/1st E. Lancs. Field Ambulance.
Capt. J. Chalmers, M.B., attached Headquarters, 95th Brigade, R.F.A.
Qmr. and Capt. J. D. Chapman, 2/3rd London Field Ambulance.
Lieut.-Col. W. K. Clayton, T.D., 57th Casualty Clearing Station.
Capt. (Acting Major) H. D. Clementi-Smith, M.B., 2/1st North Mid. Field Ambulance.
Capt. (Acting Lieut.-Col.) L. D. B. Cogan, 98th Field Ambulance.
Capt. (Acting Lieut.-Col.) J. M. A. Costello, M.C., M.B., 27th Field Ambulance.
Major (Acting Lieut.-Col.) E. H. Cox, M.B., 2/3rd E. Lancs Field Ambulance.
Capt. (Temp. Lieut.-Col.) H. H. B. Cunningham, 1/3rd E. Lancs Field Ambulance.
Capt. (Acting Major) J. Dale, M.B.
Capt. (Acting Lieut.-Col.) H. K. Dawson, D.S.O., M.D., 6th London Field Ambulance.
Capt. (Acting Lieut.-Col.) F. G. Dobson, M.B., 1/2nd West Riding Field Ambulance.
Capt. (Acting Major) H. Drummond, M.B., No. 12 Stationary Hospital.
Capt. (Temp. Lieut.-Col.) C. W. Eames, M.D., 2/2nd West Riding Field Ambulance.
Capt. (Acting Major) R. V. Favell, 1/1st West Riding Field Ambulance.
Capt. (Acting Major) N. M. Fergusson, M.B., 2/2nd London Field Ambulance.
Capt. (Acting Major) D. E. Finlay, M.B.
Capt. N. S. Finzi, 10th Casualty Clearing Station.
Qmr. and Capt. E. G. Floyd, 134th Field Ambulance.
Capt. (Temp. Major) M. G. Foster, M.D., No. 55 General Hospital.
Capt. (Acting Lieut.-Col.) J. H. P. Fraser, M.C., M.B., 53rd Field Ambulance.
Capt. (Acting Major) W. D. Frew, 131st Field Ambulance.
Major W. H. Galloway, No. 2 Stationary Hospital.
Capt. N. Gebbie, M.B., 17th Sanitary Section.
Capt. (Acting Major) J. Graham, M.B., 94th Field Ambulance.
Capt. (Acting Lieut.-Col.) F. L. A. Greaves, F.R.C.S., No. 74 General Hospital.
Capt. (Acting Major) T. W. Hancock, 47th Casualty Clearing Station.
Capt. (Acting Major) F. Hauxwell, M.B., 1/3rd W. Lancs Field Ambulance.
Major (Temp. Lieut.-Col.) A. R. Henchley, D.S.O., M.D., Commanding 48th Casualty Clearing Station.
Lieut.-Col. F. W. Higgs, M.D., 55th Casualty Clearing Station.
Lieut.-Col. (Temp. Col.) C. H. Howkins, D.S.O.
Capt. J. Jackson, 77th Sanitary Section.
Capt. R. Jacobs, 8th Sanitary Section (killed in action).
Capt. A. E. Jury.
Capt. (Acting Major) N. W. Kidston, M.B., 2/3rd Wessex Field Ambulance.
Capt. (Acting Lieut.-Col.) C. L. Lander, M.C., M.B.
Capt. H. Lightstone, D.S.O., M.C.
Capt. (Acting Major) H. B. Low, M.C., M.B., 2/2nd Northumberland Field Ambulance.
Capt. (Temp. Lieut.-Col.) J. MacMillan, M.C., M.B., 5th London Field Ambulance.
Capt. S. A. S. Malkin, attached 12th Battalion London Regiment.
Capt. (Acting Major) T. B. McKee, M.B., 2/2nd H.C. Field Ambulance.
Temp. Capt. (Acting Major) A. Mearns, M.B., 2/3rd North Mid. Field Ambulance.
Capt. (Acting Major) W. H. Morrison, M.B., 2/2nd W. Lancs Field Ambulance.
Major A. B. Murray.
Capt. J. C. Newman, M.B., F.R.C.S.
Capt. H. D. Pickles, M.C., M.B., 2/1st West Riding Field Ambulance.
Capt. (Acting Major) H. B. Pope, 2/1st West Riding Field Ambulance.
Major (Temp. Lieut.-Col.) T. P. Puddicombe, D.S.O., M.B., 25th (1/2nd Wessex) Field Ambulance.
Capt. J. Ramsay, M.D., 64th Casualty Clearing Station.
Qmr. and Capt. W. J. Rice, 88th (1/1st E. Ang.) Field Ambulance.
Capt. S. E. Rigg, attached Headquarters, 24th Labour Group.
Qmr. and Capt. W. S. Rivers, 2/1st South Mid. Field Ambulance.
Major (Temp. Lieut.-Col.) H. B. Roderick, M.D., No. 55 General Hospital.
Capt. F. W. Schofield, 1/1st E. Lancs Field Ambulance.
Capt. (Acting Lieut.-Col.) D. J. Scott, M.C., M.D., 1/2nd Low. Field Ambulance.
Capt. (Acting Lieut.-Col.) H. Seddon, M.B., 87th Field Ambulance.

Major (Acting Lieut.-Col.) J. H. Stephen, 89th Field Ambulance.
Major (Temp. Lieut.-Col.) W. G. Sutcliffe, F.R.C.S., 32nd Casualty Clearing Station.
Capt. A. White, M.B., 61st Sanitary Section.
Major (Acting Lieut.-Col.) G. F. Whyte, M.B., 2/1st Highland Field Ambulance.
Major (Acting Lieut.-Col.) P. G. Williamson, M.C., M.B., 62nd Field Ambulance.
Capt. (Acting Lieut.-Col.) T. B. Wolstenholme, M.B., 64th Casualty Clearing Station.
Capt. (Acting Lieut.-Col.) J. Young, M.B., F.R.C.S., 1/3rd Low. Field Ambulance.
497474 Pte. (Acting Cpl.) W. J. Alford, 3/3rd H.C. Field Ambulance, attached Headquarters, 58th Division.
316067 Serjt. (Acting Staff-Serjt.) J. Anderson, 1/1st Low. Field Ambulance.
536009 Serjt. (Acting Staff-Serjt.) A. J. Archer, 5th London Field Ambulance.
350124 Cpl. (Acting Serjt.) J. Bancroft, 1/1st E. Lancs Field Ambulance.
546266 Pte. (Acting Serjt.) G. Bottomley, 1/2nd London Sanitary Company.
390017 Qmr.-Serjt. (Temp. Serjt.-Major) H. M. Brown, 1/3rd Northumberland Field Ambulance.
514072 Pte. W. G. Bruce, 63rd Casualty Clearing Station.
301242 Serjt. (Acting Qmr.-Serjt.) J. Campbell, 89th Field Ambulance.
545922 Pte. T. A. Cleal, 1/2nd London Sanitary Company, attached 25th Sanitary Section.
339287 Staff-Serjt. P. Dodd, 3/2nd W. Lancs Field Ambulance.
421216 Staff-Serjt. J. Evans, 2/3rd North Mid. Field Ambulance.
401182 Pte. L. Evans, 2/1st West Riding Field Ambulance.
473235 Staff-Serjt. (Temp. Serjt.-Major) F. Edmonds, 88th Field Ambulance.
390057 Staff-Serjt. J. R. Glenton, 1/3rd Northumberland Field Ambulance.
545496 Pte. (Acting Serjt.) A. Grimsdell, 24th Sanitary Section.
401118 Staff-Serjt. W. Hemsley, 2/1st West Riding Field Ambulance.
337287 Serjt. W. E. Hooson, 87th Field Ambulance.
343069 Qmr.-Serjt. (Temp. Serjt.-Major) J. Leighton, 34th Casualty Clearing Station.
419258 Pte. (Acting Lance-Cpl.) C. H. Mayer, 1/2nd North Mid. Field Ambulance.
457265 Pte. (Acting Cpl.) H. W. Mitchell, 2/1st Wessex Field Ambulance.
528063 Staff-Serjt. (Acting Serjt.-Major) G. M. Plews, 56th Sanitary Section.
386213 Serjt. R. H. Shyvers, 1/1st Northumberland Field Ambulance.
401451 Serjt. C. E. Walker, 1/1st West Riding Field Ambulance.
461298 Pte. (Acting Cpl.) G. White, 1/3rd Wessex Field Ambulance.
528073 Cpl. J. Yeoman, Headquarters, 56th Division.

Central Chancery of the Orders of Knighthood.

Lord Chamberlain's Office,
January 1, 1919.

The King has been graciously pleased to give orders for the following promotions in, and appointments to, the Most Honourable Order of the Bath for services in connexion with the war:—

To be additional members of the Military Division of the Second Class, or Knight Commanders, of the said Most Honourable Order:—

Major-General George Joseph Hamilton Evatt, C.B., M.D.
Lieut.-General Thomas Herbert John Chapman Goodwin, C.B., C.M.G., D.S.O., K.H.S.

Chancery of the Order of Saint Michael and Saint George.

Downing Street,
January 1, 1919.

The King has been graciously pleased to give directions for the following promotions in, and appointments to the Most Distinguished Order of Saint Michael and Saint George, for services rendered in connexion with the war. Dated January 1, 1919:—

To be additional Members of the Second Class, or Knights Commanders, of the said Most Distinguished Order:—

Major-General William Watson Pike, C.M.G., D.S.O., F.R.C.S.I., A.M.S.
Temp. Colonel John Atkins, C.M.G., M.B., F.R.C.S., A.M.S.

Central Chancery of the Orders of Knighthood.

St. James's Palace, S.W.,
January 1, 1919.

The King has been graciously pleased to give orders for the following promotions in, and appointments to, the Most Excellent Order of the British Empire, for valuable services rendered in connexion with the war:—

To be Knight Commanders of the Military Division of the said Most Excellent Order:—

Temp. Hon. Col. John Lynn Thomas, C.B., C.M.G., F.R.C.S.
Col. Harry Edwin Bruce Bruce-Porter, C.M.G., Army Medical Service (T.F.).

To be Commanders of the Military Division of the said Most Excellent Order:—

Lieut.-Col. Charles Walker Cathcart, M.B., F.R.C.S.Eng., Royal Army Medical Corps (T.F.).

Col. Thomas Henry Matthews Clarke, C.M.G., D.S.O., M.B., Army Medical Service.
Col. George Dansey Browning, Army Medical Service.
Lieut.-Col. Sir Joseph Fayrer, Bart., M.D., F.R.C.S. (Edinburgh) Royal Army Medical Corps (T.F.).
Col. Richard Jennings, M.D., K.H.S., late Army Medical Service.
Major Henry John Neilson, late Royal Army Medical Corps.
Temp. Hon. Major Henry Session Souttar, F.R.C.S.Eng., M.Ch.Oxon., Royal Army Medical Corps.

To be Officers of the Military Division of the said Most Excellent Order:—
Col. William Henry Bull, F.R.C.S., V.D., Army Medical Service (T.F. Reserve).
Qmr. and Major Aguila Clapshaw, Royal Army Medical Corps (retired pay).
Major Joshua John Cox, M.D., F.R.C.S., Royal Army Medical Corps (T.F. Reserve).
Lieut. Col. John Robert Mallins, M.B., late Royal Army Medical Corps.
Brevet-Col. Charles John Willmer Tatham, retired pay, late Royal Army Medical Corps.
Capt. John Sinclair White, M.B., Royal Army Medical Corps (Special Reserve).

To be Members of the Military Division of the said Most Excellent Order:—
Temp. Capt. John Newton Martin, Royal Army Medical Corps.
Temp. Qmr. and Capt. Laurence Whittaker, Royal Army Medical Corps.
Qmr. and Capt. John Wingfield Willsher, Royal Army Medical Corps.
Lieut.-Col. P. S. O'Reilly, C.M.G., Royal Army Medical Corps.
Lieut.-Col. Sir J. G. Rogers, K.C.M.G., D.S.O., M.B., retired pay (late Army Medical Service).

To be Honorary Colonel:—
Lieut.-Col. W. H. W. Elliott, D.S.O., M.B., Retired Indian Medical Service.

To be Brevet Lieutenant-Colonel:—
(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories as applicable.)
Temp. Major F. S. Brereton, retired (late Royal Army Medical Corps).
Temp. Major G. P. Humphrey, Royal Army Medical Corps.

To be Brevet Major:—
(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories as applicable.)
Temp. Capt. R. Bruce-Lowe, Royal Army Medical Corps.
Capt. (Acting Major) A. A. Jubb, Royal Army Medical Corps (T.F.).
Capt. (Acting Major) A. T. J. McCreery, M.C., M.B., Royal Army Medical Corps.
Temp. Capt. W. T. Tulloch, M.D., Royal Army Medical Corps.

War Office,
January 6, 1919.

The following dispatch has been received by the Secretary of State for War from General F. R. Earl of Cavan, K.P., K.C.B., M.V.O., Commander-in-Chief of the British Force in Italy:—

General Headquarters,
October 26, 1918.

My Lord,—I have the honour to submit a list of names of those officers, ladies, non-commissioned officers and men serving, or who have served under my command, during the period February 26, 1918, to midnight, September 14, 1918, whose distinguished and gallant services and devotion to duty I consider deserving of special mention.

I have the honour to be, My Lord,
Your obedient servant,
(Signed) Cavan, *General*,
Commander-in-Chief the British Force in Italy.

Army Medical Service.

Lieut.-Col. (Temp. Colonel) S. A. Archer.
Lieut-Col. A. Chopping, C.M.G.
Capt. (Acting Major) M. Coplans, D.S.O., Royal Army Medical Corps (T.F.).
Col. J. V. Forrest, C.M.G., M.B.
Capt. (Acting Major) T. D. Inch, M.C., M.B.
Temp. Capt. (Acting Major) R. H. Lucas, M.C., M.B.
Major-Gen. F. R. Newland, C.B., C.M.G., M.B.
Lt.-Col. (Temp. Col.) R. Pickard, C.M.G., T.D., Royal Army Medical Corps (T.F.).
Lieut.-Col. (Temp. Col.) H. H. Tooth, C.B., C.M.G., M.D., Royal Army Medical Corps (T.F.).
Capt. (Temp. Major) S. J. A. H. Walshe, D.S.O., M.B., Royal Army Medical Corps (S.R.).
Temp. Col. C. G. Watson, C.M.G., F.R.C.S.
Capt. (Acting Major) J. D. Wells, M.B., Royal Army Medical Corps (T.F.).
Col. T. Du B. Whaite, C.M.G., M.B.

Royal Army Medical Corps.

Temp. Capt. C. J. Armstrong Dash, M.D., 70th Field Ambulance.
Major (Temp. Lieut.-Col.) J. G. Bell, D.S.O., M.B.

Major (Acting Lieut.-Col.) C. Bramhall, 51st Stationary Hospital.
Temp. Capt. D. Fisher, M.B., 69th Field Ambulance.
Lieut.-Col. C. H. Furnivall.
Temp. Capt. H. E. Gamlen, M.B., No. 11 General Hospital.
Temp. Capt. D. G. Gardiner, M.B., attd. 9th Bn. Devon R.
Temp. Capt. (Acting Major) J. Greene, M.C., 71st Field Ambulance.
Temp. Capt. (Acting Major) J. S. Hall, M.B., 9th Casualty Clearing Station.
Lieut.-Col. (Acting Col.) H. A. L. Howell.
Temp. Qmr. and Lieut. W. Langston, 22nd Field Ambulance.
Temp. Qmr. and Lieut. E. E. Larner, 69th Field Ambulance.
Temp. Capt. W. Mackenzie, M.D., F.R.C.S., attd. 9th Bn. S. Staff R.
Temp. Capt. S. Marle, attd. 1/2nd S. Mid. Field Ambulance, Royal Army Medical Corps (T.F.).
Temp. Capt. J. B. Matthews, attd. 1/4th Bn., O. and B.L.I. (T.F.).
Temp. Capt. (Acting Major) A. A. Miller, M.D., 24th Casualty Clearing Station.
Capt. (Acting Major) J. A. Renshaw.
Temp. Capt. (Acting Major) R. H. Rollinson-Whittaker, F.R.C.S., 38th Stationary Hospital.
Temp. Capt. H. S. Thomas, attd. Bucks Bn., O. and B.L.I. (T.F.).
Capt. (Acting Lieut.-Col.) E. W. Vaughan, M.C., M.B., 23rd Field Ambulance.
Lieut.-Col. J. W. West, M.B., No. 62, General Hospital.
Capt. (Acting Col.) W. G. Wright, D.S.O.
45124 Serjt. J. S. Coventry, 24th Casualty Clearing Station.
37609 Pte. F. Crosland, 23rd Field Ambulance.
106659 Pte. F. R. W. Hall, 70th Field Ambulance.
39774 Pte. C. H. Harris, 71st Field Ambulance.
8901 Pte. R. Parker, M.M., 23rd Field Ambulance.
26119 (Staff Serjt.) E. C. Perridge, 21st Field Ambulance.
19140 Serjt. J. Price, 22nd Field Ambulance.
30230 Pte. (Acting Cpl.) G. Readman, 70th Field Ambulance.

ROYAL ARMY MEDICAL CORPS (SPECIAL RESERVE).

Capt. J. E. Allan, M.B., 71st Field Ambulance.
Capt. (Acting Major) T. O. Graham, M.D., F.R.C.S.I., 71st Field Ambulance.
Capt. A. Picken, M.B., 70th Field Ambulance.

ROYAL ARMY MEDICAL CORPS (TERRITORIAL FORCE).

Capt. K. S. Beken, 75th Sanitary Section.
Capt. (Acting Lieut-Col.) R. A. Broderick, M.C., M.B., 1/2nd S. Mid. Field Ambulance.
Capt. (Acting Major) J. A. Davies, 51st Stationary Hospital.
Capt. (Acting Major) W. C. Hodges, 1/1st S. Midland Field Ambulance.
Capt. G. M. C. Moore, M.B., 1/3rd S. Midland Field Ambulance.
Capt. P. Moxey, 36th Motor Ambulance Convoy.
437014 Qmr.-Serjt. A. J. Cross, 1/2nd S. Mid. Field Ambulance.
435320 Pte. W. F. Draycott, 1/1st S. Mid. Field Ambulance.
435340 Pte. (Acting Lance-Cpl.) A. Kemp, 1/1st S. Mid. Field Ambulance.
437170 Serjt. H. Morris, 1/2nd S. Mid. Field Ambulance.
439384 Pte. J. Stone, 1/3rd S. Mid. Field Ambulance.
439106 Pte. E. G. H. Williams, 1/3rd S. Mid. Field Ambulance.

DISTINGUISHED CONDUCT MEDAL.

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Distinguished Conduct Medal to the undermentioned Non-commissioned Officers and Man for Gallantry and Distinguished Service in the Field.

241263 Cpl. (Acting Serjt.) O. Dolan, M.M., 64th West Lancs. Field Ambulance, Royal Army Medical Corps (Territorial Force), (St. Helens).

For conspicuous gallantry and devotion to duty. Seeing some infantry caught in a sudden enemy barrage, including gas, he rushed forward, and carried in one man on his back from the gas cloud. Later, though suffering from the effects of gas, he led his bearers and cleared the remainder of the wounded. By his fine action and example he saved lives.

61886 Serjt. R. H. Foster, M.M., 91st Field Ambulance, Royal Army Medical Corps (Galway).

For conspicuous gallantry and devotion to duty in charge of a party of stretcher-bearers during an attack on a village. He worked continuously from 3 a.m. to 9 p.m., clearing R.A.P.s, and while supervising the various squads was constantly exposed to very heavy shell fire. Thanks to his untiring energy about ninety severely wounded men on stretchers were safely and quickly removed, which undoubtedly saved the lives of many of them.

339017 Serjt. R. Pierce, M.M., 98th Field Ambulance, Royal Army Medical Corps) Seacombe).

For conspicuous gallantry and devotion to duty. He supervised the evacuation of wounded under heavy shelling at a bearer relay post. While assisting in lifting a stretcher case on to the wheeled carrier, a shell wounded him. Nevertheless, he at once resumed his work under

unabated shell fire, and secured the safe evacuation of several more cases, only seeking medical attention when the post was completely cleared. He behaved splendidly.

M2|131393 Pte. L. Sell, Army Service Corps (M.T.) attached No. 14 Field Ambulance, Royal Army Medical Corps (High Cross, Hants).

For conspicuous gallantry and devotion to duty. With an utter disregard for danger when roads have been under heavy shell and aircraft fire, this private has on many occasions shown marked courage in clearing cases by Ford ambulance from rear ambulance posts or from in front of those posts back to the collecting posts. He has shown a complete disregard for his own safety, and a cheerfulness and willingness beyond praise.

FOREIGN DECORATIONS AND MEDALS.

The following are among the Decorations and Medals awarded by the Allied Powers at the various dates to the British Forces for Distinguished Services rendered during the course of the campaign :—

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

DECORATIONS CONFERRED BY THE PRESIDENT OF THE FRENCH REPUBLIC.

LÉGION D'HONNEUR.

Croix d'Officier.

Col. S. F. Clark, Army Medical Service.

Croix de Guerre.

489130 Pte. Hugh Douglas Alexander Dun, 1/3rd (South Midland) Field Ambulance, Royal Army Medical Corps (Territorial Force), (Bristol).

439403 Pte. Thomas Victor Harris, 1/3rd (South Midland) Field Ambulance, Royal Army Medical Corps (Territorial Force), (Portishead).

M/288402 Pte. David McIlvenny, M.M., Army Service Corps, attached 1/3rd (South Midland) Field Ambulance, Royal Army Medical Corps (Territorial Force), (Belfast).

43035 Pte. (Acting Serjt.) David John James, M.M., 75th Field Ambulance, Royal Army Medical Corps (Tylorstown, Rhondda).

DECORATIONS AND MEDALS CONFERRED BY HIS MAJESTY THE KING OF ITALY.

Croce di Guerra.

435305 Pte. Albert John Brewer, 1/1st South Midland Field Ambulance, Royal Army Medical Corps (Territorial Force), (Alvechurch, near Birmingham).

439180 Lance-Cpl. Harry Ernest Pitman, 1/3rd South Midland Field Ambulance, Royal Army Medical Corps (Territorial Force), (Bristol).

DECORATIONS CONFERRED BY HIS MAJESTY THE KING OF THE BELGIANS.

Ordre de Leopold II.

Chevalier.

70609 Pte. Ernest Bell, Royal Army Medical Corps (Gateshead).
79983 Pte. William Birnie, Royal Army Medical Corps (Rathan).
82002 Pte. William John Green, Royal Army Medical Corps (Bedford).
33153 Serjt. Richard E. Lake, Royal Army Medical Corps (Nelson).
92309 Pte. (Acting Cpl.) Archibald McArthur, Royal Army Medical Corps (Partick, Glasgow).
53946 Pte. Joseph A. Money, Royal Army Medical Corps (Cork).
18432 Qmr.-Serjt. (Temp. Serjt.-Major) George Frederick Pearce, Royal Army Medical Corps ("E" Leeds).
49058 Pte. Hamilton Relly Taffs, Royal Army Medical Corps (Wandsworth Common, S.W.).

ROYAL ARMY MEDICAL CORPS.

Major (Acting Lieut.-Col.) Henry F. Shea, D.S.O., M.B., to be Acting Colonel whilst specially employed, dated November 26, 1918.

Capt. (Acting Major) James W. Bennett to be Acting Lieut.-Col. whilst specially employed, dated December 11, 1918.

Major Charles Pinkerton Thomson, D.S.O., is placed on the half pay list, under the provisions of Article 307, para. 7, Royal Warrant for Pay and Promotion, dated January 1, 1918.

Lieut.-Col. Ferdinand Simson Le Quesne, V.C., is placed on retired pay, dated December 25, 1918.

Lieut.-Col. James England Brogden is placed temporarily on the half pay list, dated January 5, 1919.

Major Charles W. O'Brien relinquishes the acting rank of Lieut.-Col. on reposting, dated November 16, 1918.

The undermentioned Captains to be Acting Majors :—
Dated June 18, 1918.—Campbell McQueen, M.C.
Dated September 4, 1918.—Richard A. Austin, M.C.
Dated October 21, 1918.—Desmond W. Beamish, M.C.

The undermentioned Lieutenant-Colonels to be Acting Colonels whilst employed as Assistant Directors of Medical Services of a Division.
Dated November 2, 1918.—Albert E. Hamerton, C.M.G., D.S.O.
Dated November 9, 1918.—Henry C. R. Hime, D.S.O., M.B.
Dated November 13, 1918.—(Brevet-Col.) Gilbert J. A. Ormsby, D.S.O., M.B.
The undermentioned relinquish the Acting rank of Lieutenant-Colonel on reposting.
Dated July 4, 1918.—Major William E. C. Lunn, M.C., M.B.
Dated November 2, 1918.—Major Walter J. Weston, D.S.O.
Dated November 22, 1918.—Capt. William Tyrrell, D.S.O., M.C., M.B.

The undermentioned to be Acting Lieutenant-Colonels whilst in command of a Medical Unit :—
Dated June 15, 1918.—Capt. Harold H. Leeson, M.C.
Dated September 3, 1918.—Major William E. C. Lunn, M.C., M.B.
Dated October 10, 1918.—Capt. (Acting Major) James B. A. Wigmore, M.B.
Dated November 1, 1918.—Capt. Gerald F. Rudkin, D.S.O.
Dated November 8, 1918.—Capt. (Acting Major) Maurice J. Williamson, M.C., M.B.
Dated November 20, 1918.—Capt. (Acting Major) Michael White, M.B.
Dated November 27, 1918.—Capt. (Acting Major) George D'R. Carr, M.C.

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

St. James's Palace, S.W. 1.
December 19, 1918.

The King has been graciously pleased to give orders for the following promotion in, and appointments to, the Most Excellent Order of the British Empire, for valuable services rendered within the Union of South Africa in connexion with the campaigns in German South-west Af ica and German East Africa :—

To be Officers of the said Most Excellent Order :—

SOUTH AFRICAN MEDICAL CORPS.

Major (Acting Lieut.-Col.) Paul Johannes van Collier
Lieut.-Col. Gervase Meyer de Kook
Lieut.-Col. John Robertson McGregor
Lieut.-Col. (Hon. Col.) Henry Temple Mursell

The King has been graciously pleased to make the following promotions in, and appointments to, the Most Eminent Order of the Indian Empire, in recognition of the meritorious services of the undermentioned in connexion with the war. To be dated June 3, 1918 :—

To be additional Knights Commanders of the said Most Eminent Order :—
Lieut.-Gen. Thomas Joseph O'Donnell, C.B., D.S.O., Royal Army Medical Corps, Director of Medical Services, India.

To be additional Companions of the said Most Eminent Order :—
Col. Herbert James Barratt, Royal Army Medical Corps (retired), Assistant Director of Medical Services, Meerut Division.
Col. Samuel Cowell Philson, Royal Army Medical Corps (retired), Assistant Director of Medical Services, Karachi Brigade.
His Majesty the King has been graciously pleased to give orders for the following appointments to the Most Excellent Order of the British Empire, for distinguished services in connexion with the War in India. The appointments to date from June 3, 1918 :—

To be Commanders of the said Most Excellent Order.
Col. William Molesworth, C.I.E., M.B., V.H.S., Indian Medical Service.
Col. Alfred William Sheen, M.D., Army Medical Service (T.F.).

To be Officer of the said Most Excellent Order :—
Major Albert Elijah Walter, Indian Medical Service.

St. James's Palace,
January 1, 1919.

The King has been graciously pleased to make the following promotions in, and appointments to the Most Eminent Order of the Indian Empire.
To be Companions of the said Most Eminent Order :—
Lieut-Col. John Telfer Calvert, M.B., Indian Medical Service, Principal, Medical College, Calcutta.
Major John Hanna Murray, M.D., Indian Medical Service, Andaman Islands.
Lieut.-Col. Francis Edward Swinton, Indian Medical Service, Medical Storekeeper, Bombay.
Lieut.-Col. John Charles Lamont, M.B., Indian Medical Service (retired), Professor of Anatomy, Medical College, Lahore, Punjab.

CHANCERY OF THE ROYAL VICTORIAN ORDER.

Buckingham Palace,
January 1, 1919.

The King has been graciously pleased to make the following promotion in, and appointment to, the Royal Victorian Order:—

To be Commander:—

Col. Arthur Robert Dick, C.B.

Lord Chamberlain's Office,
January 1, 1919.

The King has been graciously pleased to give orders for the following promotions in, and appointments to, the Most Honorable Order of the Bath, for valuable services rendered in connexion with the military operations in France and Flanders.

To be Additional Member of the Military Division of the Second Class, or Knights Commanders, of the said Most Honourable Order:—

Major-Gen. (Temp. Lieut.-Gen.) Charles Henry Burtchaell, C.B., C.M.G., M.B., K.H.S., Army Medical Service.

To be Additional Members of the Military Division of the Third Class, or Companions, of the said Most Honourable Order:—

Col. Charles Augustus Young, C.M.G., Army Medical Service.
Temp. Col. Andrew Fullerton, C.M.G., M.D., F.R.C.S.I., Army Medical Service.
Temp. Col. Hamilton Ashley Ballance, M.D., F.R.C.S., Army Medical Service.
Col. Theophilus Percy Jones, C.M.G., M.B., Army Medical Service.

CHANCERY OF THE ORDER OF SAINT MICHAEL AND SAINT GEORGE.

Downing Street,
January 1, 1919.

The King has been graciously pleased to give directions for the following promotions in, and appointments to, the Most Distinguished Order of Saint Michael and Saint George, for services rendered in connexion with military operations in France and Flanders. Dated January 1, 1919:—

To be Additional Members of the Third Class, or Companions, of the said Most Distinguished Order:—

Temp. Col. (Major R.A.M.C., T.F.) George Ernest Gask, D.S.O., F.R.C.S., Army Medical Service.
Col. John Poe, D.S.O., M.B., Army Medical Service.
Temp. Col. John Alexander Nixon, M.D., F.R.C.P., Army Medical Service.
Temp. Col. (Lieut.-Col. R.A.M.C., T.F.) William Errington Hume, M.B., Army Medical Service.
Lieut.-Col. William Kitson Clayton, T.D., Royal Army Medical Corps (T.F.).
Lieut..Col. (Temp. Col.) Alexander James MacDougall, M.B., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) Henry Graham Martin, Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) Standish de Courcy O'Grady, D.S.O., M.B., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) Henry Herrick, D.S.O., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) Horace Sam.
Temp. Hon. Lieut.-Col. Hugh Cabot, Royal Army Medical Corps.
Temp. Major (Acting Lieut.-Col.) Joseph Dalrymple.

CENTRAL CHANCERY OF THE ORDER OF KNIGHTHOOD.

St. James's Palace, S.W.
January 1, 1919.

The King has been graciously pleased to give orders for the following promotions in, and appointments to, the Most Excellent Order of the British Empire, for valuable services rendered in connexion with military operations in France and Flanders:—

To be Knight Commanders of the Military Division of the said Most Excellent Order:—

Temp. Col. Sir Almroth Edward Wright, Kt., C.B., M.D., F.R.C.S.I., F.R.S., Army Medical Service.
Col. (Temp. Major-Gen.) Samuel Hickson, C.B., M.B., Army Medical Service.

To be Officers of the Military Division of the said Most Excellent Order:—

Capt. (Temp. Major) Harold Cotterell Adams, Royal Army Medical Corps (T.F.)
Lieut.-Col. William John Patrick Adye-Curran, Royal Army Medical Corps.
Temp. Capt. (Acting Major) John Stanley Arkle, M.B., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) Harold Percy Waller Barrow, C.M.G., D.S.O., Royal Army Medical Corps.
Capt. (Acting Major) Charles Botterill Baxter, M.B., F.R.C.S.Edin., Royal Army Medical Corps (T.F.).
Temp. Lieut. (Acting Lieut.-Col.) James Leatham Birley, Royal Army Medical Corps.
Major Henry d'Arnim Blumberg, T.D., Royal Army Medical Corps (T.F.).
Capt. (Acting Major) Harold Burrows, M.B., F.R.C.S., Royal Army Medical Corps (T.F.).
Qmr. and Capt. John Damian Chapman, Royal Army Medical Corps (T.F.).

Temp. Capt. (Acting Major) Richard Charles, F.R.C.S.I., Royal Army Medical Corps.
Capt. Armando Dumas Child, M.B., Royal Army Medical Corps (Special Reserve).
Capt. (Acting Major) Sydney James Clegg, Royal Army Medical Corps (T.F.).
Temp. Capt. Noel Anthony Coward, M.D., Royal Army Medical Corps.
Capt. (Acting Major) William Henderson Davison, Royal Army Medical Corps (T.F.).
Temp. Major William Stewart Dickie, F.R.C.S., Royal Army Medical Corps.
Brevet Major George William Ellis, Royal Army Medical Corps (T.F.).
Temp. Capt. and Qmr. Harry Launcelot Etherington-Smith, Royal Army Medical Corps.
Temp. Major Thomas Martin Frood, Royal Army Medical Corps.
Temp. Major (Acting Lieut.-Col.) George Douglas Gray, M.D., Royal Army Medical Corps.
Capt. (Acting Lieut.-Col.) Francis Ley Augustus Greaves, Royal Army Medical Corps (T.F.),
Temp. Capt. Arthur Hyde Greg, M.B., F.R.C.S., Royal Army Medical Corps.
Capt. (Acting Major) Thomas Watson Hancock, Royal Army Medical Corps (T.F.).
Temp. Capt. (Acting Major) John Harry Hebb, M.B., Royal Army Medical Corps.
Temp. Hon. Major Thomas Houston, Royal Army Medical Corps.
Capt. Arthur Ernest Jury, Royal Army Medical Corps (T.F.).
Temp. Capt. Robert Douglas Laurie, M.B., Royal Army Medical Corps.
Temp. Capt. Lancelot Raoul Lempriere, M.B., Royal Army Medical Corps.
Major (Temp. Lieut.-Col.) Frank Alexander McCammon, M.B., M.C., Royal Army Medical Corps.
Temp. Capt. James Walter McLeod, M.B., Royal Army Medical Corps.
Temp. Capt. (Acting Major) Wilfred George Mumford, M.B., F.R.C.S., Royal Army Medical Corps.
Capt. John Campin Newman, M.B., F.R.C.S., Royal Army Medical Corps (T.F.).
Capt. Benjamin Alexander Odlum, Royal Army Medical Corps.
Qmr. and Capt. (Temp. Major) Joseph Thomas Packard, Royal Army Medical Corps.
Temp. Capt. Edward Irving Pownel Pellew, Royal Army Medical Corps.
Capt. Jeffret Ramsay, M.D., Royal Army Medical Corps (T.F.).
Temp. Capt. (Acting Major) Thomas Clark Ritchie, Royal Army Medical Corps,
Lieut.-Col. (Temp. Col.) Alfred Bertram Soltau, C.M.G., M.D., Royal Army Medical Corps (T.F.).
Major (Temp. Lieut.-Col.) William Greenwood Sutcliffe, Royal Army Medical Corps (T.F.).
Major (Acting Lieut.-Col.) Thomas Barton Unwin, M.B., Royal Army Medical Corps.
Temp. Qmr. and Capt. James Varley, Royal Army Medical Corps.
Capt. (Acting Major) William Warwick Wagstaffe, M.B., Royal Army Medical Corps (Special Reserve).
Temp. Capt. Kenneth Macfarlane Walker, M.B., F.R.C.S., Royal Army Medical Corps.
Temp. Capt. (Acting Major) Humphrey Bowstead Wilson, M.D., Royal Army Medical Corps.
Capt. (Acting Lieut.-Col.) Thomas Blakeway Wolstenholme, Royal Army Medical Corps (Territorial Force).
Capt. (Acting Lieut.-Col.) Frank Worthington, D.S.O., M.B., Royal Army Medical Corps.
Temp. Qmr. and Capt. George Robert Spring, Royal Army Medical Corps.

Overseas Military Forces of Canada.

To be Officers of the Military Division of the said Most Excellent Order :—
Lieut.-Col. Percy Gordon Brown, Canadian Army Medical Corps.
Major John Frederick Burgess, Canadian Army Medical Corps.
Major Robert James McEwan, Canadian Army Medical Corps.
Lieut.-Col. Hugh Edwin Munroe, Canadian Army Medical Corps.
Major Hurold Orr, Army Medical Corps.

Australian Imperial Force.

To be Officers of the Military Division of the said Most Excellent Order :—
Major David Moore Embelton, Australian Army Medical Corps.
Major Charles Napier Finn, Australian Army Medical Corps.
Major (Temp. Lieut.-Col.) Alfred Fay Maclure, Australian Army Medical Corps.
Lieut.-Col. William George Dismore Upjohn, Australian Army Medical Corps.

War Office,
January 1, 1919.

His Majesty the King has been graciously pleased to approve of the undermentioned rewards for Distinguished Service in connection with Military Operations in France and Flanders, dated January 1, 1919:—

To be Major-General :—
Col. (Temp. Major-Gen.) J. Thomson, C.B., M.B., Army Medical Service.

To be Brevet-Colonel :—
(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories as applicable.)
Lieut.-Col. (Temp. Col.) R. S. H. Fuhr, C.M.G., D.S.O., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) A. G. Thompson, C.M.G., D.S.O., M.B., Royal Army Medical Corps.

To be Brevet Lieutenant-Colonel :—
(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories as applicable.)
Major W. H. G. H. Best, Royal Army Medical Corps (Special Reserve).
Major (Temp. Lieut.-Col.) R. A. Bryden, D.S.O., Royal Army Medical Corps.
Major (Temp. Lieut.-Col.) P. J. Hanafin, D.S.O., Royal Army Medical Corps.
Major (Temp. Lieut.-Col.) H. S. Peeke, Reserve of Officers, late Royal Army Medical Corps.
Major (Temp. Lieut.-Col.) D. Rorie, D.S.O., M.D., Royal Army Medical Corps (Territorial Force).
Major G. F. Sheeham, D.S.O., Royal Army Medical Corps.
Temp. Capt. S. P. Hodkinson, M.B., Royal Army Medical Corps.
Capt. (Acting Major) L. W. O. Taylor, Royal Army Medical Corps (Special Reserve).
Capt. (Acting Major) W. L. Webster, M.B., Royal Army Medical Corps.

AWARDED THE DISTINGUISHED SERVICE ORDER.

Capt. (Temp. Lieut.-Col.) James Barkley, Royal Army Medical Corps (Territorial Force), attached 2/3rd (Home Counties) Field Ambulance, Royal Army Medical Corps (Territorial Force).

Capt. (Acting Lieut.-Col.) Robert Burgess, M.C., Royal Army Medical Corps (Territorial Force), attached 24th 1/1st (Wessex) Field Ambulance.

Major (Acting Lieut.-Col.) Alexander Callam, M.B., Royal Army Medical Corps (Territorial Force), attached 1/1st (E. Lancs), Field Ambulance.

Capt. (Acting Lieut.-Col.) Lee Danby Buxton Cogan, 88th Field Ambulance, Royal Army Medical Corps (Territorial Force).

Major (Acting Lieut.-Col.) Edward Harvie Cox, M.B., 2/3rd (E. Lancs) Field Ambulance, Royal Army Medical Corps (Territorial Force).

Capt. (Acting Lieut.-Col.) Francis George Dobson, M.B., Royal Army Medical Corps (Territorial Force), attached 1/2nd (West Riding) Field Ambulance.

Capt. (Acting Major) Thomas Ingram Dun, M.C., M.B., Royal Army Medical Corps.

Capt. (Temp. Lieut.-Col.) Charles William Eames, M.D., Royal Army Medical Corps (Territorial Force), attached 2/2nd (West Riding), Field Ambulance.

Major (Acting Lieut.-Col.) Clive Thornley Edmunds, 57th Field Ambulance, Royal Army Medical Corps.

Major (Acting Lieut.-Col.) William Henry Forsyth, M.B., 38th Field Ambulance, Royal Army Medical Corps.

Capt. (Acting Lieut.-Col.) Cyril James Anthony Griffin, M.B., Royal Army Medical Corps (Special Reserve), attached 5th Vav. Field Ambulance.

Capt. (Acting Lieut.-Col.) Cyril Helm, M.C., 42nd Field Ambulance, Royal Army Medical Corps.

Temp. Capt. (Acting Major) Alexander Edmond Knight, M.C., M.B., Royal Army Medical Corps.

Capt. (Acting Lieut.-Col.) Charles Llewellyn Lander, M.C., M.B., Royal Army Medical Corps (Territorial Force), attached 2/3rd (S.M.) Field Ambulance, Royal Army Medical Corps (Territorial Force).

Major (Acting Lieut.-Col.) Stuart Gerald McAllum, M.D., Royal Army Medical Corps (Special Reserve), attached 140th Field Ambulance.

Lieut.-Col. (Temp. Col.), Farquhar McLennan, M.B., Royal Army Medical Corps.

Capt. (Acting Lieut.-Col.) John MacMillan, M.C., M.B., Royal Army Medical Corps, attached 5th (London) Field Ambulance, Royal Army Medical Corps (Territorial Force).

Capt. (Acting Lieut.-Col.) Charles Max Page, M.B., F.R.C.S., Royal Army Medical Corps (Special Reserve), attached 90th Field Ambulance.

Temp. Capt. (Acting Major) Montgomery Paterson Paton, M.C., M.B., Royal Army Medical Corps.

Major (Acting Lieut.-Col.) Thomas Trevor Hull Robinson, M.B., Royal Army Medical Corps, No. 5 Field Ambulance.

Major (Acting Lieut.-Col.) John Hector Stephen, 89th (High) 1/1st Field Ambulance, Royal Army Medical Corps (Territorial Force).

Temp. Capt. (Acting Lieut.-Col.) Robert Svensson, M.C., M.B., Royal Army Medical Corps, 102nd Field Ambulance.

Capt. (Acting Lieut.-Col.) James Young, M.B., 1/3rd (Low.) Field Ambulance, Royal Army Medical Corps (Territorial Force).

AWARDED SECOND BAR TO MILITARY CROSS.

Capt. Hugh Kingsley Ward,* M.C., M.B., Royal Army Medical Corps, Special Reserve, attached 2nd Battalion K.R.R.C. (M.C. gazetted October 20, 1916.)

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* The announcement of the award of First Bar has not yet been published in the *London Gazette*; this award will be published in due course.

AWARDED A BAR TO THE MILITARY CROSS.

Temp. Capt. (Acting Major), James Biggam, M.C., M.B., Royal Army Medical Corps.

Capt. Edwin John Bradley, M.C., M.D., Royal Army Medical Corps (Special Reserve), attd. 1/3rd (North Midland) Field Ambulance.

AWARDED THE MILITARY CROSS.

Qmr. and Capt. Thomas Barradell, 1st North Midland Field Ambulance, attd. 1/1st (Northumberland) Field Ambulance, Royal Army Medical Corps (Territorial Force).

Capt. (Acting Major) William Roy Blore, M.B., Royal Army Medical Corps (Special Reserve), attd. 35th Field Ambulance.

Temp. Capt. Angus Buchanan, M.B., 49th Field Ambulance, Royal Army Medical Corps.

Capt. (Acting Major) Guy Oldham Chambers, Royal Army Medical Corps, attd. Headquarters, Cavalry Corps.

Temp. Capt. Charles Francis Drew, M.B., No. 9 Field Ambulance, Royal Army Medical Corps.

Capt. Ernest McMurchie Dunlop, M.B., Royal Army Medical Corps (Territorial Force), attd. 14th Battalion Worcester Regiment.

Temp. Capt. (Acting Major) John Gibson, M.B., 98th Field Ambulance, Royal Army Medical Corps.

Qmr. and Capt. William Goodly, 136th Field Ambulance, Royal Army Medical Corps.

Capt. Francis Henry Guppy, Royal Army Medical Corps (Special Reserve), attd. 8th Medical Army Corps.

Temp. Capt. (Acting Major) Ernest Leon Maunsell Hackett, 8th Field Ambulance, Royal Army Medical Corps.

Capt. George Leslie Matthews, 1st (London) San. Co., Royal Army Medical Corps.

Temp. Qmr. and Lieut. James Moore, 16th Field Ambulance, Royal Army Medical Corps.

Capt. (Acting Major) Clark Nicholson, M.B., Royal Army Medical Corps (Special Reserve), attd. 49th Field Ambulance.

Capt. (Acting Major) Arthur Patrick O'Connor, M.B., 11th Field Ambulance, Royal Army Medical Corps.

37565 Serjt.-Major Samuel Alfred Patman, 56th Field Ambulance, Royal Army Medical Corps.

Temp. Capt. James Farquharson Powell, Royal Army Medical Corps, attd. Headquarters, 76th Brigade, Royal Garrison Artillery.

Temp. Capt. Charles Reginald Reckett, Royal Army Medical Corps, attd. 26th Brigade, Royal Field Artillery.

Capt. (Acting Major) Henry Edward Sutherland Richards, M.D., 2/1st West Lancaster Field Ambulance, Royal Army Medical Corps (Territorial Force).

Capt. (Acting Major) Frederick Ernest Woodham Rogers, 2/3rd (Home Counties) Field Ambulance, Royal Army Medical Corps (Territorial Force).

Temp. Capt. Stanley Parke Stoker, M.B., Royal Army Medical Corps, attd. 1/6th Battalion West Riding Regiment (Territorial Force).

Capt. (Acting Lieut.-Col.) David Henderson Weir, Royal Army Medical Corps (Territorial Force), attd. 112th Field Ambulance.

Temp. Capt. (Acting Major) Brian Whitehead, Royal Army Medical Corps, attd. 59th Division, Headquarters.

Temp. Capt. John Wylie, M.B., Royal Army Medical Corps, attd. 6th Battalion East York Regiment.

Canadian Force.

Qmr. and Capt. Thomas Barclay, 13th Canadian Field Ambulance, Canadian Army Medical Corps.

Australian Imperial Force.

Capt. Norman MacKay, Australian Army Medical Corps, attd. 55th Battalion, Australian Infantry.

New Zealand Force.

Capt. Norman Harrison Dempster, M.B., New Zealand Medical Corps, attd. 3rd Battalion, New Zealand Rifle Brigade.

Capt. Alexander Duncan Shanks Whyte, New Zealand Medical Service, attd. 2nd Brigade Headquarters, New Zealand Field Artillery.

AWARDED THE DISTINGUISHED CONDUCT MEDAL.

417081 Pte. H. Bridgman, 1st (North Midland) Field Ambulance, Royal Army Medical Corps, Territorial Force (Derby).

339298 Staff-Serjt. W. Brookes, M.M., 63rd (West Lancs) Field Ambulance, Royal Army Medical Corps, Territorial Force (Liverpool).

435120 Staff-Serjt F. C. Burling, 2/1st (South Midland) Field Ambulance, Royal Army Medical Corps, Territorial Force (Birmingham).

1772 Serjt. (Acting Qmr.-Serjt.) M. A. Butler, M.M., 1st Field Ambulance, Royal Army Medical Corps, (Reading).

48579 Staff-Serjt. (Acting Serjt.-Major) G. T. Davies, 130th Field Ambulance, Royal Army Medical Corps (Pontardawe).

538144 Pte. (Acting Corpl.) W. Fowler, 6th (London) Field Ambulance, Royal Army Medical Corps (Territorial Force), attd. 1/21st Field Ambulance (Hanwell).

33476 Corpl. I. E. Jones, 140th Field Ambulance, Royal Army Medical Corps (Port Talbot).

354015 Qmr. Serjt. (Temp. Serjt.-Major) G. W. Langford, 2/3rd (East Lancs) Field Ambulance, Royal Army Medical Corps, Territorial Force (Manchester).

339006 Qmr.-Serjt. (Temp. Serjt.-Major) D. G. Martin, 98th Field Ambulance, Royal Army Medical Corps (Liverpool).

320119 Corpl. A. Mennie, Royal Army Medical Corps (Territorial Force), attd. 5/6 Battalion, Royal Scots, Territorial Force (Aberdeenshire).

30408 Serjt.-Major A. Oxley, 136th Field Ambulance, Royal Army Medical Corps (Tinsley).

60454 Pte. (Acting Serjt.) H. J. Peacock, 113th Field Ambulance, Royal Army Medical Corps (Stoke-on-Trent).

65933 Pte. P. A. Reed, 133rd Field Ambulance, Royal Army Medical Corps (Clapham).

48462 Corpl. (Acting Staff-Serjt.) F. A. Tarling, 131st Field Ambulance, Royal Army Medical Corps (Aberavon).

18734 Serjt. (Acting Staff-Serjt.) S. Wilson, 142nd Field Ambulance, Royal Army Medical Corps (Warwick).

8748 Pte. (Acting Serjt.) A. H. Wragg, 4th Field Ambulance, Royal Army Medical Corps (Marple, Chester).

Central Chancery of the Order of the Knighthood.

Lord Chamberlain's Office,
January 1, 1919.

The King has been graciously pleased to give orders for the following promotions in, and appointments to, the Most Honourable Order of the Bath, for valuable services rendered in connexion with military operations in Egypt:—

To be Additional Members of the Military Division of the Second Class, or Knights Commanders, of the said Most Honourable Order:—

Temp. Lieut.-Col. Herbert Lightfoot Eason, C.M.G., M.D., Royal Army Medical Corps.

To be Additional Member of the Third Class, or Companion, of the Most Distinguished Order:—

Lieut.-Col. (Temp. Col.) Evelyn Pierce Sewell, D.S.O., M.B., Royal Army Medical Corps.

St. James's Palace, S.W.,
January 1, 1919.

The King has been graciously pleased to give orders for the following appointments to the Most Excellent Order of the British Empire for valuable services rendered in connexion with military operations in Egypt:—

To be Commanders of the Military Division of the said Most Excellent Order:—

Temp. Col. Charles Coley Choyce, M.D., F.R.C.S., Royal Army Medical Corps.

Lieut.-Col. (Temp. Col.) Cathcart Garner, M.B., R.P., late Royal Army Medical Corps.

To be Officers of the Military Division of the said Most Excellent Order:—

Capt. Rupert Briercliffe, M.B., Royal Army Medical Corps (Territorial Force).

Temp. Capt. Frank Holt Diggle, M.B., F.R.C.S., Royal Army Medical Corps.

Major William Dyson, M.D., Royal Army Medical Corps (Territorial Force).

Major (Acting Lieut.-Col.) William Francis Ellis, Royal Army Medical Corps.

Temp. Capt. William Wood Forbes, Royal Army Medical Corps.

Temp. Capt. (Acting Major) Harold Arthur Fox, Royal Army Medical Corps.

Temp. Capt. Norman Stephen Gilchrist, M.D., Royal Army Medical Corps, attd. Royal Air Force.

Major Farquhar Gracie, M.B., Royal Army Medical Corps (Territorial Force).

Capt. David Livingstone Graham, M.B., Indian Medical Service.

Capt. John Inglis, Royal Army Medical Corps (Territorial Force).

Capt. Thomas Fuller Kennedy, M.B., Royal Army Medical Corps.

Major (Acting Lieut.-Col.) John William Mackenzie, M.D., Royal Army Medical Corps (Territorial Force).

Capt. (Acting Major) Lachlan Martin Victor Mitchell, M.B., Royal Army Medical Corps (Territorial Force).

Temp. Capt. Charles William Smith, M.B., F.R.C.S., Royal Army Medical Corps.

Lieut.-Col. George Elliot Frank Stammers, Royal Army Medical Corps.

Major Gerard Charles Taylor, M.D., Royal Army Medical Corps (Territorial Force).

Major Frederick Beaumont Treves, M.B., Royal Army Medical Corps (Territorial Force).

Capt. (Temp. Lieut.-Col.) Phillip Sefton Vickerman, M.B., F.R.C.S., Royal Army Medical Corps (Special Reserve).

Capt. (Acting Major) Alexander Pirie Watson, M.B., F.R.C.S., Royal Army Medical Corps (Territorial Force).

Temp.-Lieut. Kaikebad Rustonyf Madan, Indian Medical Service.

To be Members of the Military Division of the said Most Excellent Order:—

Temp. Qmr. and Lieut. Walter James Baldwin, Royal Army Medical Corps.

Temp. Qmr. and Lieut. Frederick William Cudmore, Royal Army Medical Corps.
Capt. Joseph Green, M.D., D.P.H., Royal Army Medical Corps (Territorial Force).
Temp. Qmr. and Lieut. Arthur William Shreeve, Royal Army Medical Corps,

Australian Imperial Force.

To be Commanders of the Military Division of the said Most Excellent Order:—
Lieut.-Col. (Temp. Col.) Graham Patrick Dixon, Australian Army Medical Corps.
To be Officers of the Military Division of the said Most Excellent Order:—
Lieut.-Col. Charles Bickerton Blackburn, Australian Army Medical Corps.
Major Niel Hamilton Fairley, Australian Army Medical Corps.
Lieut.-Col. (Temp. Col.) Robert Fowler, Australian Army Medical Corps.
Lieut.-Col. John Colvin Storet, Australian Army Medical Corps.

War Office,
January 1, 1919.

His Majesty the King has been graciously pleased to approve of the undermentioned rewards for Distinguished Service in connexion with military operations in Egypt. Dated January 1, 1919:—

To be Brevet-Colonel:—

Lieut.-Col. E. E. Powell, D.S.O., Royal Army Medical Corps.

To be Brevet Lieutenant-Colonel:—

(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories as applicable.)

Major (Acting Lieut.-Col.) A. W. Gibson, Royal Army Medical Corps.

To be Brevet-Major:—

(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories, as applicable.)

Temp. Capt. P. H. Bahr, D.S.O., M.D., Royal Army Medical Corps.

AWARDED THE DISTINGUISHED SERVICE ORDER.

Major Leonard Avery Abery, Royal Army Medical Corps (Territorial Force), attached 1/1st Royal Bucks Hussars, Yeomanry.

Major (Acting Lieut.-Col.) John Evans, M.D., Royal Army Medical Corps (Territorial Force).

AWARDED THE MILITARY CROSS.

Captain (Acting Major) John Herd Beverland, M.B., Royal Army Medical Corps, Special Reserve, attached 165th Indian Combined Field Ambulance.

Temp. Capt. Gordon John Cruikshank Ferrier, Royal Army Medical Corps, attached 129th Indian Combined Field Ambulance.

Capt. (Temp. Major) Leslie Price Harris, Royal Army Medical Corps (Territorial Force).

Capt. William Francis Theodore Haultain, M.B., Royal Army Medical Corps, Special Reserve, attached 29th Lancers, Indian Army.

Temp. Lieut. Burjorji H. Kamakaka, Indian Medical Service, attached 1st Battalion, 128rd Outram's Rifles, Indian Army.

Capt. (Acting Major) Leonard Milton, 2/4th (London) Field Ambulance, Royal Army Medical Corps.

Temp. Capt. Harry James Rae, M.B., Royal Army Medical Corps.

Temp. Capt. Francis Charles Robbs, Royal Army Medical Corps, attached 1st Battalion, Royal Irish Regiment.

Capt. (Acting Major) Alfred Bernard Pavey Smith, 2/6th Battalion, London Field Ambulance, Royal Army Medical Corps.

Australian Imperial Force.

Capt. Colin Anderson, 4th Australian Light Horse Field Ambulance, Australian Army Medical Corps.

Capt. John Fortescue Grantley Fitzhardinge, Australian Army Medical Corps, attached 5th Australian L.H.R.

AWARDED THE DISTINGUISHED CONDUCT MEDAL.

363863 Serjt. E. H. Forster, Royal Army Medical Corps, attached 154th Indian Combined Field Ambulance (Weaste, Salford).

57341 Pte. D. McWalter, 2/1st (Ang.) Field Ambulance, Royal Army Medical Corps (Territorial Force) (Dundee).

434011 Serjt. W. E. S. Taylor, 1/2nd (South Midland) Mounted Brigade Field Ambulance, Royal Army Medical Corps (Territorial Force), attached 10th Cavalry Brigade, Combined Field Ambulance (Stony Stratford).

His Majesty the King has been graciously pleased to approve of the award of the Meritorious Service Medal to the following Warrant Officers, Non-commissioned Officers and Men, in recognition of valuable service rendered with the Forces in Egypt:—

ROYAL ARMY MEDICAL CORPS.

23524 Serjt.-Major G. J. Debney (Toronto).
13892 Serjt.-Major H. Dixon, 71st General Hospital (Northampton).
401012 Qmr.-Serjt. (Temp. Serjt.-Major) C. Barber (Leeds).
433016 Qmr.-Serjt. A. R. Baxter (Territorial Force) (Shrewsbury).
311022 Qmr.-Serjt. (Temp. Serjt.-Major) R. Clarke (Territorial Force) (Aberfeldy).
44517 Qmr.-Serjt. W. Derbyshire, 24th Stationary Hospital (St. Anne's-on-Sea).
14761 Qmr.-Serjt. (Temp. Serjt.-Major) W. Robertson (Nunhead, S.E.).
545649 Staff-Serjt. E. L. Ashbrook, 2nd London Sanitary Corps (Territorial Force) (Tooting, S.W.)
5015 Serjt. (Acting Qmr.-Serjt.) R. J. Beisly (Cairo, Egypt).
371006 Serjt. (Acting Staff-Serjt.) T. D. Hill, 53rd D. S. Section (Cardiff).
69598 Staff-Serjt. J. Hindle, 24th Stationary Hospital (Bolton).
505036 Staff-Serjt. P. Schofield, 67th Sanitary Section (Territorial Force) (Milton Regis).
53449 Cpl. (Acting Staff-Serjt.) L, Freeborough 68th General Hospital (Penge).
59583 Cpl. (Acting Serjt.) A. R. Savage, 66th Casualty Clearing Station (Dingle).
73604 Pte. R. Harrison (Birthey).
533072 Pte. (Acting Staff-Serjt.) E. C. Stamp (Territorial Force) (Hornsey, N.).
69400 Pte. (Acting Staff-Serjt.) J. C. Talbot, D.D.M.S., 21st Army Corps (Shorncliffe).

CHANCERY OF THE ORDER OF SAINT MICHAEL AND SAINT GEORGE.

Downing Street,
January 1, 1919.

The King has been graciously pleased to give directions for the following appointments to the Most Distinguished Order of Saint Michael and Saint George, for services rendered in connexion with Military Operations in Italy. Dated January 1, 1919:—

To be additional Members of the Third Class, or Companions of the said Most Distinguished Order:—

ROYAL ARMY MEDICAL CORPS.

Lieut.-Col. (Temp. Col.) Samuel Arthur Archer
Lieut.-Col. (Acting Col.) Harry Arthur Leonard Howell
Lieut.-Col. John Weir West, M.B.
Lieut.-Col. Charles Hilton Furnivall

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

St. James's Palace, S.W.,
January 1, 1919.

The King has been graciously pleased to give orders for the following appointments to the Most Excellent Order of the British Empire for valuable services rendered in connexion with Military Operations in Italy:—

To be Officers of the Military Division of the said Most Excellent Order:—

Capt. (Acting Major) Thomas Douglas Inch, M.C., M.B., Royal Army Medical Corps.
Capt. Andrew Picken, M.B., Royal Army Medical Corps (S.R.).
Capt. (Acting Major) Joseph Douglas Wells, M.B., Royal Army Medical Corps (Territorial Force).

War Office,
January 1, 1919.

His Majesty the King has been graciously pleased to approve of the undermentioned rewards for distinguished service in connexion with Military Operations in Italy. Dated January 1, 1919:—

To be Brevet-Colonels:—
Lieut.-Col. A. Chopping, C.M.G., Royal Army Medical Corps.
Major (Temp. Lieut-Col.) J. G. Bell, D.S.O., M.B., Royal Army Medical Corps.

To be Brevet-Major:—
(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories, as applicable.)
Capt. (Acting Col.) W. G. Wright, D.S.O., Royal Army Medical Corps.

AWARDED THE DISTINGUISHED SERVICE ORDER.

Capt. (Acting Lieut.-Col.) Ralph Alexander Broderick, M.C., M.B., 1/2nd Battalion S. Mid. Brigade, Field Ambulance, Royal Army Medical Corps (Territorial Force).

Temp. Capt. William Mackenzie, M.B., Royal Army Medical Corps, attd. 9th Battalion, S. Staff R.

AWARDED THE MERITORIOUS SERVICE MEDAL.

Royal Army Medical Corps.

40725 Serjt.-Major W. G. Elcombe, 22nd Field Ambulance (Forest Gate).
14464 Serjt.-Major G. F. Hurran, 62nd General Hospital (South Woodford).
437009 Qmr. Serjt. G. Rutter, 2nd (S. Mid.) Field Ambulance (Territorial Force), (Walsall).

32285 Serjt. G. E. J. Bushnell, 71st Field Ambulance (Chelsea).
439309 Serjt. H. P. Harrison, 3rd (S. Mid.) Field Ambulance (Territorial Force), (Bristol).
439235 Cpl. E. J. W. Champion, 3rd (S. Mid.) Field Ambulance (Territorial Force), (Poole).
58928 Pte. (Acting Qmr. Serjt.) W. H. Croasdell, 70th Field Ambulance (Peckham).
9372 Pte. G. W. Elwell, 21st Field Ambulance (South Hemsall).
34780 Pte. (Acting Lieut.-Col.) D. Maltby, 69th Field Ambulance (Nottingham).
82380 Pte. (Acting Serjt. Major) E. J. Pratt, attd. D.D.M.S. (G.H.Q.), (Weston-super-Mare).

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

Lord Chamberlain's Office,
January 1, 1919.

The King has been graciously pleased to give orders for the following promotions in, and appointments to, the Most Honourable Order of the Bath, for valuable services rendered in connexion with Military Operations in Salonika :—

To be additional Members of the Military Division of the Third Class, or Companion of the said Most Honourable Order :—

Temp. Col. Arthur George Phear, M.D., F.R.C.P.

Capt. and Brevet-Major (Temp. Col.) Robert Ernest Kelly, Royal Army Medical Corps (Territorial Force).

CHANCERY OF THE ORDER OF SAINT MICHAEL AND SAINT GEORGE.

Downing Street,
January 1, 1919.

The King has been graciously pleased to give directions for the following promotion in, and appointments to, the Most Distinguished Order of Saint Michael and Saint George, for services rendered in connexion with Military Operations in Salonika, dated January 1, 1919.

To be additional Member of the Third Class or Companion of the said Most Distinguished Order :—

Lieut.-Col. Claude Buist Martin, M.B., Royal Army Medical Corps.

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

St. James's Palace, S.W.
January 1, 1919.

The King has been graciously pleased to give orders for the following appointments to the Most Excellent Order of the British Empire for valuable services rendered in connexion with Military Operations in Salonika.

To be Officers of the Military Division of the said Most Excellent Order :—

Temp. Capt. (Acting Major) David Irvine Anderson, M.B., Royal Army Medical Corps.
Temp. Capt. James Connor Maxwell Bailey, M.D., Royal Army Medical Corps.
Temp. Capt. (Acting Major) George Victor Bakewell, M.B., Royal Army Medical Corps.
Capt. (Acting Major) Thomas Yuille Barkley, M.B., Royal Army Medical Corps (Special Reserve).
Lieut.-Col. Michael Boyle, M.B., Royal Army Medical Corps.
Temp. Capt. Amos Hubert Coleman, M.B., Royal Army Medical Corps.
Temp. Capt. James Anthony Delmege, Royal Army Medical Corps.
Temp. Capt. Robert Richard Elworthy, M.D., Royal Army Medical Corps.
Capt. (Acting Major) Walter Barham Foley, M.B., Royal Army Medical Corps (S.R.).
Major William Rickards Galwey, M.C., M.B., Royal Army Medical Corps.
Major (Temp. Lieut.-Col.) John Gray, Royal Army Medical Corps (Territorial Force).
Lieut.-Col. John Edward Hodgson, Royal Army Medical Corps.
Capt. Hugh Ernest McColl, M.B., Royal Army Medical Corps (Special Reserve).
Lieut.-Col. Peter Mitchell, M.D., Royal Army Medical Corps (Territorial Force).
Capt. (Acting Major) Julian Taylor, F.R.C.S., Royal Army Medical Corps (Territorial Force).
Lieut.-Col. Frederick Edward Apthorpe Webb, Royal Army Medical Corps Territorial Force).
Lieut. (Temp. Capt. Acting Major) Reginald Anson Mansell, M.B., Royal Army Medical Corps.
Temp. Lieut. John Ramsbottom, Royal Army Medical Corps.

To be Brevet Lieutenant-Colonel :—

(On Retired List, Reserve of Officers, Special Reserve, New Army or Territorial Force, in the case of Officers belonging to these categories as applicable.)

Major (Temp. Lieut.-Col.) J. A. Anderson, M.B., Royal Army Medical Corps.

To be Brevet Major :—

(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories as applicable.)

Capt. (Temp. Major) R. E. Barnsley, M.C., Royal Army Medical Corps.
Capt. (Acting Major) W. F. Christie, M.B., Royal Army Medical Corps.
Capt. (Temp. Major) M. J. Williamson, M.C., Royal Army Medical Corps.

To be granted the next higher rate of pay under the provisions of the Royal Warrant:—
Temp. Qmr. and Lieut. G. E. Barney, Royal Army Medical Corps.
Temp. Qmr. and Lieut. W. F. Grocott, Royal Army Medical Corps.

AWARDED THE MILITARY CROSS.

Capt. Roderic Duncan Cameron, M.B., Royal Army Medical Corps (Special Reserve).
Capt. Geoffrey Bede Egerton, Royal Army Medical Corps (Special Reserve).
Temp. Capt. (Acting Major) George Bedingfield Holroyde, Royal Army Medical Corps.
Capt. Leonard James Sheil, M.D., Royal Army Medical Corps (Special Reserve).
Capt. Herbert Watt Torrance, M.B., Royal Army Medical Corps (Special Reserve).
Capt. Leonard Henry Wootton, M.B., Royal Army Medical Corps (Territorial Force).
Capt, Mervyn Clement Cooper, Royal Army Medical Corps (Special Reserve).

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

St. James's Palace, S.W. 1.
January 8, 1919.

The King has been graciously pleased to give orders for the following promotions in, and appointments to, the Most Excellent Order of the British Empire for services in connexion with the War.

To be Knights Commanders of the Civil Division of the said Most Excellent Order:—

Edward Napier Burnett, J.P., M.D., F.R.C.S., F.R.C.P., Chairman of the Economic Committee of the Army Medical Department, War Office.

Col. William Hale White, M.D., Royal Army Medical Corps, Chairman and Consultant, Queen Mary's Royal Naval Hospital, Southend.

To be Commanders of the Civil Division of the said Most Excellent Order:—

INDIA.

Col. William George Beyts, Army Medical Service, Assistant Director of Medical Services, Bombay Brigade.

To be Officers of the Civil Division of the said Most Excellent Order:—

Major-Gen. Phillip Mackay Ellis, County Director, Auxiliary Hospitals and V.A.D.s, Carnarvonshire.

Robert William Johnstone, Esq., M.D., F.R.C.S., Commissioner of Medical Services, Ministry of National Service.

Capt. Lionel Edward Close Norbury, M.B., F.R.C.S., Surgeon, British Red Cross Hospital, Netley.

Miss Eugenie Josephine Oudin, M.B.E., Private Secretary to Adjutant-General.

Major David Valentine Rees, T.D., L.R.C.P., M.R.C.S., Operating Surgeon, Brecon and Builth Auxiliary Hospitals.

Major Charles Sempill de Segundo, V.D., M.B., B.S., Deputy Commissioner of Medical Services, Ministry of National Service.

Capt. Henry Adrian Fitzroy Wilson, Secretary and Registrar, British Red Cross Hospital, Netley.

INDIA.

Lieut.-Col. Frank Stuart Corbitt Thompson, M.B., Indian Medical Service, Superintendent, Presidency Jail, Bengal.

War Office,
January 11, 1919.

His Majesty the King has been graciously pleased to approve of the following awards to the undermentioned Officers in recognition of their gallantry and devotion to duty in the field:—

AWARDED A BAR TO DISTINGUISHED SERVICE ORDER.
Canadian Force.

Lieut.-Col. Anson Scott Donaldson, D.S.O., 3rd Field Ambulance, Canadian Army Medical Corps.

For conspicuous gallantry and devotion to duty. This officer was in charge of the evacuation of the forward area, and showed great initiative in establishing dressing stations and collecting posts directly in rear of the advancing infantry. He kept in touch with the battalion and succeeded in evacuating the casualties almost as soon as they occurred, in spite of heavy machine gun and shell fire. (D.S.O. gazetted June 3, 1918.)

Lieut.-Col. Thomas Joseph Francis Murphy, D.S.O., 6th Field Ambulance, Canadian Army Medical Corps.

During an attack there were several wounded cases whose evacuation was being held up by intense enemy barrage. This officer then brought up two motor ambulances, which he left some distance in rear, and came up with his runner to the village and searched for the regimental aid posts, which he found after much difficulty, all the time exposed to heavy fire himself—as he passed several times through the enemy barrage and machine gun fire. It was through his utter disregard of personal danger that the wounded were safely cleared and many lives saved. (D.S.O. gazetted January 1, 1918.)

AWARDED THE DISTINGUISHED SERVICE ORDER.

Capt. (Acting Lieut.-Col.) Thomas Henry Scott, M.C., 14th Field Ambulance, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. When the vicinity of his advanced dressing station was being heavily shelled, it was due to his coolness and able management that a number of stretcher and walking cases were evacuated quickly and smoothly. His foresight and organization were mainly responsible for the very large numbers of officers and men successfully evacuated during this period under most difficult conditions.

Capt. (Temp. Major) William Duncan Sturrock, M.D., Royal Army Medical Corps, Territorial Force, Salonika.

For conspicuous gallantry and devotion to duty when the main surgical ward and operating tent of a field ambulance were wrecked by shell fire, one officer and two other ranks being wounded. He very quickly put matters right, and owing to the excellent arrangements made by him throughout the operations, the wounded, in spite of the difficult country and lack of roads, were very rapidly collected and evacuated.

Major (Acting Lieut.-Col.) George Grant Tabuteau, No. 1, Field Ambulance, Royal Army Medical Corps

For conspicuous gallantry and devotion to duty in supervising the evacuation of casualties during three days' operations under heavy shell fire. He maintained a chain of medical posts in close touch with the battalions of his brigade, and the rapid removal of the wounded was due to his coolness and untiring energy, which inspired his officers and men with confidence.

Australian Imperial Force.

Major John Charles Campbell, 7th Field Ambulance, Australian Army Medical Corps.

For conspicuous gallantry and devotion to duty. This officer was in charge of stretcher bearers, evacuating all wounded from the right sector of the advance throughout five days' fighting. He kept close behind the infantry and kept in touch with the various medical officers under constant heavy fire. One night a direct hit completely demolished his aid post, but he got his men to a place of safety and continued the evacuation of the wounded. He superintended the work for five days continuously with great courage and persistence, setting a fine example to all under him.

AWARDED A SECOND BAR TO MILITARY CROSS.

Temp. Captain (Acting Major) John Samuel Levis, M.C., M.B., 51st Field Ambulance, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. During an attack, when the regimental aid posts were under direct enemy observation, this officer, approaching them over ground swept by machine gun fire, made arrangements for the wounded to be evacuated by a safer route. He was indefatigable in the day in keeping touch with the aid posts as they moved forward, and during the night took stretcher bearers up to the front line to search for wounded. (M.C. gazetted January 26, 1917. Bar gazetted July 26, 1918.)

Captain (Acting Major) Campbell McNeil McCormack, M.C., 15th Field Ambulance, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. During various attacks this officer supervised the collecting of wounded over a large part of the divisional front. He closely followed the advancing troops with his stretcher bearers, evacuating the wounded skilfully and speedily. On one occasion during a retirement he personally, under heavy fire, reconnoitred the ground where the wounded lay, and by his dispositions of the stretcher bearers undoubtedly saved their lives and the lives of many of the wounded. (M.C. gazetted September 22, 1916. Bar gazetted October 15, 1918.)

Temp. Capt. Charles Gordon Timms, M.C., Royal Army Medical Corps, attd. 7th Battalion Royal Fusiliers.

For conspicuous gallantry and devotion to duty. During a counter attack this officer went forward from battalion headquarters and effected several rescues of seriously wounded men, conducting them personally to the lines. Throughout the week's fighting he worked night and day, and the manner in which he disposed of stretcher cases under heavy fire was admirable. (M.C. gazetted July 18, 1917. Bar gazetted July 26, 1918.)

AWARDED A BAR TO MILITARY CROSS.

Capt. William James Dowling, M.C., M.B., Royal Army Medical Corps (Special Reserve), attd. 3rd Battalion M.G.C., Temp. attd. 142nd Field Ambulance.

He was in charge of stretcher bearers during very heavy fighting, lasting for two days, and repeatedly went forward to satisfy himself that the R.A.P. were being kept clear. On many occasions he himself led forward stretcher squads under very heavy fire. He invariably displayed great gallantry, and afforded a magnificent example to all ranks working under him. (M.C. gazetted December 2, 1918.)

Capt. (Acting Major) John Cecil Alexander Dowse, M.C., M.B., Royal Army Medical Corps, attd. Headquarters, 63rd Division.

For conspicuous gallantry and devotion to duty. This officer controlled the evacuation of wounded from the whole of the divisional front under artillery, machine gun and rifle fire, and

their rapid and efficient evacuation was due to his untiring zeal and energy in maintaining constant communications between battalions and field ambulances. He set a splendid example to all ranks. (M.C. gazetted January 14, 1916.)

Lieut. William Peat Hogg, M.C., Indian Medical Service, Mesopotamia.

For conspicuous gallantry and devotion to duty. When his aid post was heavily shelled he collected all his casualties with great coolness and promptitude, and conducted them to a new post. He has previously done similar fine work in action. (M.C. gazetted February 7, 1918.)

Temp. Capt. (Acting Major) Maurice Aloysius Power, M.C., Royal Army Medical Corps, attd. 148th Field Ambulance.

For conspicuous gallantry and devotion to duty. Whilst in charge of stretcher bearers he attended to and collected wounded under heavy machine gun fire. He worked unceasingly, directing stretcher-bearers, and evacuated several hundred wounded men from the R.A.P.s in his sector. Although wounded (for the third time) he remained on duty and showed great endurance as on previous occasions. (M.C. gazetted January 18, 1918.)

Capt. (Acting Major) Cuthbert Scales, M.C., M.B., Royal Army Medical Corps, attd. 150th Field Ambulance.

For conspicuous gallantry and devotion to duty when in charge of stretcher bearers. He exposed himself continually, moving from place to place to collect the wounded under heavy machine gun fire. Thanks to the close touch which he kept with the battalions, several hundred wounded were quickly collected and evacuated. (M.C. gazetted July 26, 1918.)

Capt. Thomas Walker, M.C., M.B., Royal Army Medical Corps, Special Reserve, attd. 2/3rd London Field Ambulance.

For conspicuous gallantry and devotion to duty. He took a motor ambulance car to an advanced regimental aid post under very heavy shell fire and evacuated the wounded. Throughout the whole action he displayed great skill and disregard of danger in handling his bearers, and was night and day in the line, keeping touch with the regiments, under heavy shell fire. (M.C. gazetted November 4, 1918.)

Temp. Capt. Philip Hewer Wells, M.C., Royal Army Medical Corps, attd. 2nd Battalion C. Gds.

When moving up to an aid post with the battalion headqarters a shell fell on the party, causing many casualties, including the other only officer. Capt. Wells, showing complete disregard for personal safety, organized the party and attended to the wounded. Throughout the day he ceaselessly carried on his duties, and under most trying conditions, being exposed to heavy shell fire the whole time. In spite of the number of wounded he managed to attend to all and arrange for their evacuation. (M.C. gazetted February 18, 1918.)

Canadian Force.

Capt. Hugh Hart, No. 5 Field Ambulance, Canadian Army Medical Corps.

During an action this officer was in charge of the field ambulance stretcher-bearers. His work under very heavy machine gun and shell fire was characterized by a thoroughness and a clear and concise idea of the situation at all times which was due to his keeping close touch with the rapidly advancing infantry. On this and other occasions he cleared all casualties with exceptional rapidity. His courage and tireless persistence were a source of inspiration to all under him. (M.C. gazetted July 18, 1917.)

Capt. (Acting Major) Herbert William Wadgo, M.C., No. 10 Field Ambulance, Canadian Army Medical Army.

This officer was in charge of the stretcher-bearers of the ambulance during five days' fighting. He worked continuously, directing the evacuation of the wounded in the forward area. Under his leadership the bearers worked strenuously, and the wounded were evacuated with great rapidity. Although considerably shaken by the explosion of a shell, he continued his work. (M.C. gazetted August 19, 1916.)

New Zealand Force.

AWARDED THE MILITARY CROSS.

Lieut. Bawa Harkishan Singh, Indian Medical Service, Mesopotamia.

For conspicuous gallantry and devotion to duty and coolness under fire when in charge of the dressing station of the ambulance. The dressing station came under heavy fire at night, and the situation was critical for a time. He, however, collected the wounded and brought them in. He also showed great coolness and initiative when the ambulance was bombed by aeroplanes during and after the attack.

Temp. Capt. Frederick Orlando Clarke, Royal Army Medical Corps, attached 149th Field Ambulance.

For conspicuous gallantry and devotion to duty in attending to and evacuating the wounded from the forward area under heavy rifle and machine-gun fire. He worked on until every case had been evacuated, and set a splendid example of zeal and endurance to all ranks under him.

Temp. Capt. Andrew Leslie Edmund Filmer Coleman, M.D., Royal Army Medical Corps, attached 2nd Battalion Scots Guards.

For conspicuous gallantry, tireless energy and devotion in tending the wounded during operations. For two days and nights he never left his post, though subjected to continuous

machine-gun fire and frequent bombardments of high explosives and gas. During this period a continuous stream of wounded poured in, both from his own and other units, and by his prompt attention and ceaseless hard work he undoubtedly saved the lives of many severely wounded ones.

Capt. (Acting Major) Frank Coleman, 6th London Field Ambulance, Royal Army Medical Corps.
He displayed conspicuous gallantry and devotion to duty at an advanced dressing station which was frequently under heavy shell fire and night bombing. He attended to and arranged for the evacuation of a very large number of wounded, and his skill and organization were the means of saving several lives.

Temp. Capt. Purser Davies, M.B., Royal Army Medical Corps, attached 6th (London) Field Ambulance, Royal Army Medical Corps.
He worked with little or no rest for sixty hours in the open under heavy fire, dressing and evacuating the wounded. His conspicuous example of gallantry and self-sacrificing devotion to duty were an inspiration to the stretcher bearers, whose services he organized with great ability. He saved many lives by his skill.

Temp. Capt. Trevor G. Featherstonhaugh, M.B., Royal Army Medical Corps (Mesopotamia).
For conspicuous gallantry and devotion to duty in attending to the wounded and withdrawing them to cover. In doing so he had constantly to move across ground exposed to fire. It was due to his ability and coolness that casualties were evacuated so expeditiously, thus preventing any hampering of the critical operation in progress at the time.

Temp. Capt. John Finnegan, M.D., Royal Army Medical Corps, attached 7th Battalion, Lincolnshire Regiment.
For conspicuous gallantry and devotion to duty. At one time, when the battalion was held up lining a bank, he continued to move up and down what was actually the front line, under enfilade fire, attending to, and evacuating wounded of his own battalion and also of other divisions. By his disregard of danger for himself he saved lives of numerous others.

Temp. Capt. Douglas Hugh Aird Galbraith, Royal Army Medical Corps (Mesopotamia).
For conspicuous gallantry and devotion to duty. He was wounded in the head whilst attending to a wounded officer, and though in great pain, continued to carry out his duties for the remainder of the day with zeal and determination.

Temp. Capt. Edwin Lancelot Hopkins, Royal Army Medical Corps, Mesopotamia.
For conspicuous gallantry and devotion to duty in dressing wounded under fire during a reconnaisance. He has on all occasions displayed great coolness and resource in carrying out his work.

Capt. Alexander Johnstone, Royal Army Medical Corps, Mesopotamia.
For conspicuous gallantry and devotion to duty. He displayed the utmost energy and coolness in collecting, dressing and evacuating the wounded under heavy fire. Through his untiring efforts 200 cases were disposed of in a very short time.

Temp. Capt. James Gaymer Jones, Royal Army Medical Corps, Mesopotamia.
For conspicuous gallantry and devotion to duty. Although exposed to heavy and continuous shell fire throughout the day, he continued to dress the wounded in the gun line, thereby alleviating much suffering and saving many lives. His courage on all occasions has been most marked.

Temp.-Lieut. Ratenshaw Nariman Kapadia, Indian Medical Service, Mesopotamia.
For conspicuous gallantry and devotion to duty. Exposed to heavy fire, he continued throughout the action to collect and dress the wounded, who were much scattered, thereby saving many lives.

Temp. Lieut. Douglas Burrowes Leitch, Royal Army Medical Corps, attached 13th Brigade Welsh Regiment.
For conspicuous gallantry and devotion to duty. When his battalion came under heavy shell and machine gun fire he went forward and rendered first aid to men lying in the open and removed them to cover, being shot at by snipers and machine guns while doing so. His zeal and disregard of danger throughout the operations were splendid. Finally he was severely wounded.

Temp. Capt. Joseph Patrick McGreehin, M.B., Royal Army Medical Corps, attached 4th Battalion, Royal Fusiliers.
While proceeding to assembly positions he was knocked over by a large piece of shell and badly shaken. Nevertheless he pushed on, and established his operating post behind a bank. Unfortunately, unknown to him, it was in the vicinity of a water point, and was very accurately shelled all day and finally hit. In spite of this, he worked on with the greatest courage, dressing with care all the wounded, and in one case amputating a foot.

Temp. Capt. William Millerick, Royal Army Medical Corps, attached 10th Battalion, Argyle and Sutherland Highlanders.
For conspicuous gallantry and devotion to duty. Hearing that there were a number of severely wounded cases in a village, which could not be moved until properly dressed, this

officer at once went forward and carried out his duties under heavy fire of every description. He continued his work untiringly throughout the day, and by his skilful organization of dressing and carrying parties was undoubtedly responsible for saving many lives.

Temp. Capt. Frederick Harold Moran, Royal Army Medical Corps, attached 15th Brigade, Royal Field Artillery,

For conspicuous gallantry and devotion to duty during an advance. Throughout the operations he maintained his aid post practically at the battery positions, and dressed wounded of many units under heavy shell fire. He more than once passed through heavy barrage to get at and attend to wounded. His zeal and disregard of personal safety were splendid.

Temp. Capt. (Acting Major) Duncan Metcalfe Morison, 38th Field Ambulance, Royal Army Medical Corps.

When the Infantry were ordered to attack at short notice he went forward through a heavy barrage and completed the necessary arrangements with the medical officer of the battalion for evacuation of the wounded. His gallantry and devotion to duty ensured the wounded being rapidly cleared and many lives were saved thereby.

Lieut. (Temp. Capt.) William Douglas Newland, 92nd Field Ambulance, Royal Army Medical Corps.

Under conditions of open warfare he collected a number of wounded for evacuation. The place came under very heavy shell fire due to a number of tanks passing close to his post. With great courage and devotion he remained with the wounded until he was able to clear them all, although the fire was so heavy that all troops had to leave the immediate neighbourhood.

Temp.-Lieut. George Fitzpatrick Rigden, M.B., Royal Army Medical Corps, attached 16th Battalion Lancashire Fusiliers.

He established a first-aid post well forward, and in spite of heavy machine gun fire carried on his duties with admirable self-possession, several times going forward in face of intense fire to dress wounded lying in exposed positions. It was largely due to his unselfish devotion that some of the most serious cases received prompt attention. His courage throughout was most marked. Finally he was wounded.

Capt. Lewis Wilson Shelly, Royal Army Medical Corps, attached No. 1, Aeroplane Supply Depot, Royal Air Force.

For conspicuous gallantry and devotion to duty. When this depot was heavily bombed in a night air raid he organized a dressing station at the repair park, attending the wounded in the open. Several bombs fell close to him, wounding those around him, but he stuck to his work and saved the lives of many by his coolness and courage.

Capt. Charles Gordon Strachan, M.B., Royal Army Medical Corps, Territorial Force, Salonika.

For conspicuous gallantry and devotion to duty in charge of stretcher bearers. He worked for twenty-four consecutive hours across open ground which was constantly shelled. He rallied his bearers when somewhat exhausted and disorganized by heavy fire, and set them a very fine example of cheerfulness and complete disregard of personal labour. The successful evacuation of all wounded was largely due to his personal conduct.

Canadian Force.

Capt. Sidney George Baldwin, No. 9. Field Ambulance, Canadian Army Medical Corps.

For conspicuous gallantry and devotion to duty. Under his direction the wounded were dressed and removed from the battlefield without any delay. He often led his bearers through machine gun fire to reach wounded men, whom he successfully evacuated. All through the fighting he displayed great disregard of danger.

Capt. Neil Douglas Black, Canadian Army Medical Corps, attd. 25th Battalion, Canadian Infantry, Nova Scotia R.

For conspicuous gallantry and devotion to duty. With absolute indifference to the heavy shell fire, this officer advanced with the leading companies and attended to the wounded. The second afternoon of the attack he advanced beyond the line under intense enemy machine gun fire and dressed the wounded of other battalions. His coolness and example were a source of inspiration to officers and men.

Capt. Tillman Alfred Briggs, Canadian Army Medical Corps, attd. 116th Battalian Canadian Infantry, second C. Ont. R.

During an attack he rendered invaluable assistance to the wounded of this and other battalions. He attended to a number of casualties in the jumping-off position in spite of heavy machine gun and artillery barrage. Most of his dressers became casualties, but he continued to dress the wounded. As soon as he had attended to those he pushed forward across the open and assisted those who had fallen. His services were most valuable, and his work of a very high order. He displayed remarkable coolness and energy under fire.

Capt. Herman Maclean Cameron, No. 3 Field Ambulance, Canadian Army Medical Corps.

For conspicuous gallantry and devotion to duty. This officer performed valuable work in establishing a new A.D.S. to conform with the advancing line, under heavy machine gun fire and artillery barrage, working continuously for twenty-four hours without rest.

Capt. David Dawson Freeze, Canadian Army Medical Corps, attd. R. Can. R.

In an attack he displayed great courage in dressing wounded under heavy shell and machine gun fire. He followed close up with the battalion in the attack, and in the most exposed position he continued to dress the wounded and organize carrying parties, so that all the battalion casualties were evacuated in very a short time. After the objective had been reached he proceeded in advance under heavy machine gun fire, and dressed the wounds of a large number of the enemy and evacuated them. Learning that a number of men of another division were lying in front of our line, having been wounded two days previously, he proceeded under heavy fire, dressed their wounds and supervised their evacuation. His devotion to duty throughout was admirable.

Capt. Arthur Hines, Canadian Army Medical Corps, attd. 26th Battalion N. Brunswick R.

For conspicuous gallantry and devotion to duty during an attack. He went forward with the attacking waves, and on numerous occasions in the open and in face of the heaviest shell and machine gun fire, dressed the wounded. His utter disregard of danger was a constant source of inspiration to all ranks.

Capt. James Stewart Hudson, Canadian Army Medical Corps, attached 1st Battalion Canadian Mounted Rifles.

For conspicuous gallantry and devotion to duty during operations. He attended to the wounded under exceptionally heavy shell and machine gun fire. He personally superintended the collection of wounded, and organized stretcher parties. His coolness and courageous conduct set a high example to all.

Capt. Roy Bertram Jenkins, Canadian Army Medical Corps, attached 24th Battalion Canadian Infantry, Quebec Regiment.

For conspicuous gallantry and devotion to duty. During two days' fighting this officer accompanied the troops and was tireless in attending to the wounded under heavy shell, gas and machine gun fire. As soon as the battalion had made good its line he established a rear aid post close up, where he received and evacuated wounded. Being exposed to fire himself, he arranged what cover was possible for the wounded, and continued at work until he was sure all had been cleared. He worked unceasingly, never thinking of himself.

Capt. Robert Dewar MacKenzie, Canadian Army Medical Corps, attached 15th Battalion Canadian Infantry, 1st C, Ontario Regiment.

For conspicuous gallantry and devotion to duty. He dressed wounded under continuous shell fire, and kept moving his dressing station forward, so as to be able to attend to the more serious cases. He cleared the cases with the utmost dispatch, and many times during the day went up, under shell and machine gun fire, to dress stretcher cases. His conduct throughout was deserving of high praise.

Capt. Donald Campbell Malcolm, 8th Field Ambulance, Canadian Army Medical Corps.

He was in charge of the bearer division in the left sector during the fighting. He showed great initiative and judgment at all times, keeping in close touch with the advancing troops and clearing the wounded. He worked continuously for forty-eight hours searching for and attending the wounded in the open. On one occasion when the advance was delayed near a wood, he led his stretcher squads across the open ground which was being swept by machine gun fire, and brought many wounded back to safety. He displayed the greatest coolness under fire and a perfect disregard for personal safety during the entire action.

Capt. Joseph Regis Alberic Marin, Canadian Army Medical Corps, attached 22nd Battalion, Quebec Regiment.

For conspicuous gallantry and devotion to duty during an attack. He, through his prompt dressing of wounds under heavy shell and machine gunfire, alleviated the sufferings of many wounded and saved the lives of some of the more seriously wounded. His fearless example had the best possible effect on the *moral* of the men. He worked with determination and cheerfulness for two days under very trying and dangerous conditions.

Capt. Duncan Arnold Morrison, 1st Field Ambulance, Canadian Army Medical Corps.

For conspicuous gallantry and devotion to duty. He accompanied the advancing infantry to the final objective, and though wounded himself remained on duty, continuing to do excellent work during two days' operations, establishing an A.D.S. as soon as the infantry passed through. He behaved splendidly.

Capt. Robert Davies Moyle, 2nd Field Ambulance, Canadian Army Medical Corps.

For conspicuous gallantry and devotion to duty. He followed the infantry into the open while it was still under machine-gun fire. Owing to the condition of the ground it was impossible to get transport up, but he organized bearer parties, collected all wounded into a place of safety, and succeeded in securing dressings, food and water for them, saving many lives. He set an example to all ranks under him.

Capt. Frederick McGregor Petrie, Canadian Army Medical Corps, attached 31st Battalion Alberta Regiment.

This officer displayed great courage, coolness and devotion to duty under heavy fire and in most trying conditions. He showed great executive ability in the evacuation of wounded, and

although the casualties were very heavy, at no time was there any congestion at the R.A.P. By his skilful organization and untiring energy, many wounded were evacuated during the operation.

Capt. Roy Hindley Thomas, 1st Field Ambulance, Canadian Army Medical Corps.

For superintending the evacuation of wounded when he went over the entire area, still under heavy fire, locating the wounded, and after dark succeeding in safely removing them all. His untiring devotion to duty, initiative in establishing collecting posts and organization of carrying parties undoubtedly saved many lives.

AMENDMENTS.

The following is the correct description of the officer named, upon whom a reward has recently been conferred.

Major David William McKechnie, D.S.O., No. 6 Field Ambulance, Canadian Army Medical Corps. (D.S.O. gazetted December 2, 1918.)

War Office,
January 16, 1919.

The names of the undermentioned have been brought to the notice of the Secretary of State for War by Major-General F. C. Poole, C.B., C.M.G., D.S.O., General Officer Commanding, North Russian Expeditionary Force, for valuable and distinguished services rendered in connexion with the operations in North Russia:—

Lieut. F. Evans, Royal Army Medical Corps (Territorial Force).

Lieut.-Col. T. McDermott, M.B., Royal Army Medical Corps.

395044 Pte. (Acting Serjt.) W. H. Snow, Royal Army Medical Corps.

ARMY MEDICAL OFFICERS' WIDOWS AND ORPHANS FUND.

SUMMARY OF THE PROCEEDINGS OF A QUARTERLY MEETING OF THE COMMITTEE WHICH WAS HELD AT THE ROYAL ARMY MEDICAL COLLEGE ON JANUARY 16, 1919.

Present.

Deputy Surg.-Gen. W. G. Don, Vice-President, in the Chair.
Major-Gen. W. S. M. Price.
Major-Gen. Sir H. R. Whitehead, K.C.B.
Major W. C. Smales, D.S.O.

(1) The Proceedings of the Meeting of October 17, 1918, were read and confirmed.

(2) The deaths were reported of the following members:—

Lieut.-Col. J. More Reid on November 18, 1918, aged 62.

Lieut.-Col. P. S. O'Reilly, C.M.G., on November 18, 1918, aged 41.

Lieut.-Col. J. E. Hodgson, on November 8, 1918, aged 44.

The widows of the two latter were placed on the list of annuitants. Lieut.-Col. Reid was unmarried.

The death was reported of an annuitant, Mrs. Stacey Skipton, aged 71, on October 7, also that of the wife of Lieut.-Col. R. L. Love, on October 30.

(3) The question was considered of suspending the present extra war premium of £15 15s. per annum charged to new entrants into the Society.

The Secretary read a letter from the Actuary in which he said that he was of opinion that the Committee may accept new entrants to the Fund as from November 11 last, the date of the Armistice, at the ordinary rates subject to the power of the Committee to reconsider the position at any time. He added that in the case of those members who have paid the extra £15 15s. he thought that a return should be made of the proportion of the extra charge from November 11 to the date when the next annual payment falls due.

It was proposed by Major-Gen. Price, seconded by Major-Gen. H. R. Whitehead, and carried unanimously that these recommendations of the Actuary be adopted, and the Secretary be authorized to put them into effect.

The Secretary submitted a draft of a notice explaining the present conditions of membership and the benefits offered by the Society, which was approved for circulation amongst officers of the Corps, especially those who have joined since the outbreak of war.

(4) The Secretary reported that his present period of office would expire on March 31 next. The matter was considered, and the following resolution was carried unanimously on the motion of the Chairman, seconded by Major-Gen. Price—"That Capt. J. T. Clapham be re-elected Secretary of the Society for a further period of five years from April 1, 1919; and that on account of his invaluable services to the Society during the past ten years his salary be increased to £200

per annum, with an office allowance of £60 per annum, as at present, and that his nomination and increase of salary be submitted to the next Annual General Meeting for confirmation."

(5) The Secretary reported that, as authorized at the previous meeting, £2,500 from cash surplus had been invested in five per cent National War Bonds, 1928; making a total of £5,000 invested in these Bonds during the year 1918.

(6) A certificate from the Actuary that the securities held by the Society are officially recognized as Trustee Securities was submitted.

(7) Payment of the Secretary's salary and office allowance for the past quarter was sanctioned, as was refund to him of petty cash expended.

3, Homefield Road,
Wimbledon, S.W. 19.

J. T. CLAPHAM, *Captain,*
Secretary.

ROYAL ARMY MEDICAL CORPS FUND.

MINUTES OF A COMMITTEE MEETING HELD AT ADASTRAL HOUSE, WAR OFFICE, ON JANUARY 23, 1919.

Present.

Lieut.-Gen. Sir T. H. J. C. Goodwin, K.C.B., C.M.G., D.S.O., K.H.S., D.G.A.M.S., in the Chair.
Major-Gen. G. B. Stanistreet, C.B., C.M.G., D.D.G.
Major-Gen. Sir W. Donovan, K.C.B.
Major-Gen. Sir D. Bruce, K.C.B.
Col. Sir J. Magill, K.C.B.
Lieut.-Col. A. B. Cottell.
Major P. G. Easton, D.S.O.
Major E. P. Offord.
Capt. E. B. Allnutt, M. C., Band President.

(1) The minutes of the last meeting held on October 15, 1918, were read and confirmed.

(2) The accounts for the year 1918 were considered and approved subject to audit.

(3) The question of the annual dinner was considered and it was decided to postpone the decision until the next meeting.

(4) The band accounts for the three months from October 1 to December 31, 1918, were submitted by the Band President, and a grant of £50 authorized, such grant to include the continuance of the war bonus—a copy of the accounts is attached.

(5) The Secretary reported the action of the Memorials Sub-Committee up to date. It was noted:—

- (i) That the portrait of Sir A. Keogh is in process of completion and
- (ii) That the portrait of Sir A. Sloggett has been finished. The Secretary was directed to send cheque to the artist accordingly.
- (iii) As regards the memorial to certain distinguished officers the Committee expressed a wish to see a drawing or photograph of the design which is at present under the consideration of the artist consequent on alterations suggested by the Memorials Sub-Committee.

(6) The book of rules was discussed and it was considered that no alterations are required.

(7) It was decided that certain receipt and cash books, the property of the Royal Army Medical Corps Prisoners of War Fund, should be purchased at a cost of £2.

(8) The disposal of old correspondence, etc., which has accumulated was discussed, and the Secretary was authorized to destroy whatever is more than ten years old, provided that after examination it is considered to be unnecessary.

GENERAL RELIEF BRANCH.

(1) The Secretary reported the investment of £500 in National War Bonds, 1928, in accordance with the decision of the Committee at its last meeting, also receipt piastres 5,000 (£50) from the Royal Army Medical Corps Depot, Kantara, Egypt.

(2) The Secretary reported the issue of two grants of £3 each to soldiers in temporary distress —approved.

(3) Two applications for further assistance from Mr. M. K. Q. and Mrs. L. E. S. were considered and a grant of £6 authorized in each case.

A fresh application submitted by Major Offord on behalf of the widow of a soldier recently deceased was ordered to be dealt with.

(4) An application for an additional subscription made by the Union Jack Club on the grounds of the large increase in the numbers of the Royal Army Medical Corps (Regular Army) during the war was considered, and it was decided to continue the usual subscription of £25 4s. and to give a special donation of £25 for the present year.

ROYAL ARMY MEDICAL CORPS.

Band Depot.

Recapitulation of Accounts, October 1 to December 31, 1918.

Income.

	£	s.	d.
Balance brought forward	77	9	9
Grant from R.A.M.C. Fund	60	0	0
Fees for Performances	184	0	0
	£321	9	9

Expenditure.

	£	s.	d.
Salaries	39	17	0
Instruments	23	12	3
Fees for Peformances	153	15	0
Bonus to Band	27	0	0
Repairs	0	6	0
Music	2	7	7
Expenses—Travelling	2	18	0
Postage	0	0	4
Balance	71	13	7
	£321	9	9

Blackpool,
January 20, 1919.

E. B. ALLNUTT, *Captain,*
Adjutant, Depot, R.A.M.C.

ROYAL ARMY MEDICAL CORPS OFFICERS' BENEVOLENT SOCIETY.

MINUTES OF A COMMITTEE MEETING HELD AT ADASTRAL HOUSE, WAR OFFICE, ON JANUARY 23, 1919.

Present.

Lieut.-Gen. Sir T. H. J. C. Goodwin, K.C.B., C.M.G., D.S.O., K.H.S., D.G., in the Chair.
Major-Gen. Sir W. Donovan, K.C.B.
Major-Gen. Sir D. Bruce, K.C.B.
Major-Gen. Sir H. R. Whitehead, K.C.B.
Major-Gen. Sir M. W. Russell, K.C.M.G., C.B.
Col. A. Peterkin, C.B.
Col. H. W. Murray.
Lieut.-Col. A. B. Cottell.
Capt. J. T. Clapham.

(1) The minutes of the last meeting held on October 15, 1918, were read and confirmed.

(2) The accounts for the year 1918 were considered and approved, subject to audit, and it was noted that in consequence of the special appeal last year, the subscriptions had increased from £184 18s. 6d. to £324 7s. 6d.

(3) The Secretary reported that in addition to the foregoing, sixty-nine other officers had signed orders on their bankers for subscriptions of £1 1s. each, for the present year.

(4) The Secretary reported special grants made in two cases of urgent distress under Rule 31—approved.

(5) Two estimates for reprinting the book of Rules, the stock of which is now exhausted, were considered, and it was decided to accept the offer of the Army and Navy Co-operative Society—500 copies to be printed.

(6) The Secretary reported the investment of £200 in five per cent National War Bonds, 1928, as directed by the last meeting.

(7) It was decided to send out the application forms to orphans to whom grants have previously been made, accompanied in each case, as was done last year, by a letter explaining that this action was not to be regarded as a guarantee that a grant would be made.

(8) The disposal of old correspondence, etc., which had accumulated, was discussed, and authority was given to the Secretary to examine and destroy such as appeared to be unnecessary, provided that it was more than ten years old.

BIRTH.

LONGHURST.—On February 9, 1919, at 20, Ladbroke Gardens, W., the wife of Lieut.-Colonel B. W. Longhurst, R.A.M.C., of a son.

DEATH.

O'DWYER.—On February 5, at a nursing home, Thomas Francis O'Dwyer, Surgeon-General, Army Medical Staff (retired), aged 77, of 4, Rodney Cottages, Clifton, Bristol. Funeral at Canford, Saturday.

ROYAL ARMY MEDICAL COLLEGE.

LIST OF BOOKS ADDED TO THE LIBRARY DURING THE MONTHS OF OCTOBER, NOVEMBER AND DECEMBER, 1918.

Title of Work and Author	Edition	Date	How obtained
Hygiene of the Eye. By W. Campbell Posey, A.B., M.D.		1918	**Library Grant.**
The Causes of Tuberculosis. By L. Cobbett, M.D. ..		1917	,, ,,
Technical Handbook of Oils, Fats and Waxes. Vol. I, Chemical and General. By P. J. Fryer and T. E. Weston		1918	,, ,,
Fatty Foods, their Practical Examination. By E. R. Bolton and C. Revis		1918	,, ,,
Practical Organic and Bio-chemistry. By R. H. A. Plimmer	New	1918	,, ,,
Infection, Immunity and Specific Therapy. By John A. Kolmer, M.D.	2nd	1918	,, ,,
A Manual of Bacteriology. By R. T. Hewlett, M.D. ..	6th	1918	,, ,,
War Surgery of the Abdomen. By Cuthbert Wallace, C.M.G.		1918	,, ,,
Genito-urinary Surgery and Venereal Diseases. By White and Martin	10th	1917	,, ,,
The Elements of the Science of Nutrition. By G. Lusk, Ph.D.., F.R.S.	3rd	1917	,, ,,
Principles and Practice of Milk Hygiene. By Louis A. Klein		1917	,, ,,
Sanitary Law and Practice. By Robertson and Porter ..	4th	1917	,, ,,
Anæsthetics. By J. Blomfield, M.D.	4th	1918	,, ,,
Elements of Field Hygiene and Sanitation. By Col. J. H. Ford, Medical Corps, U.S.A.		1918	,, ,,
Symptoms and their Interpretation. By Sir James Mackenzie, M.D.	3rd	1918	,, ,,
The Sensory and Motor Disorders of the Heart. By A. Morison, M.D.		1914	,, ,,
Massage and Medical Gymnastics. By Dr. Emil A. G. Klein. Translated by M. L. Dobbie		1918	,, ,,
The Analyst's Laboratory Companion. By A. E. Johnson, B.Sc.	4th	1912	,, ,,
Psychological Medicine. By Maurice Craig, M.A., M.D.	3rd	1917	,, ,,
Surgical Applied Anatomy. By Sir F. Treves, G.C.V.O., C.B. Revised by A. Keith, M.D., and W. C. Mackenzie, M.D.	7th	1918	,, ,,
A Text-book of Pathology. By W. G. MacCallum ..		1918	,, ,,
A Simple Method of Water Analysis. By J. C. Thresh, M.D., D.P.H.	9th	1918	,, ,,
Organic Compounds of Arsenic and Antimony. By G. T. Morgan, D.Sc., F.R.S.		1918	,, ,,
The Conduction of the Nervous Impulse. By Keith Lucas, Sc.D., F.R.S. Revised by E. D. Adrian, M.B.		1917	,, ,,
Lecithin and the Allied Substances. The Lepins. By Hugh Maclean, M.D., D.Sc.		1918	,, ,,
Edible Oils and Fats. By C. A. Mitchell, B.A., F.I.C. ..		1918	,, ,,
Chemical Constitution of the Proteins. By R. H. A. Plimmer, B.Sc. Part 1: Analysis	3rd	1918	,, ,,
Hæmaturia, its Causes and Diagnosis. By David Newman, M.D.		1915	,, ,,
Pyuria, its Causes and Diagnosis. By David Newman, M.D.		1916	,, ,,

LIST OF BOOKS ADDED TO THE LIBRARY—*Continued.*

Title of Work and Author	Edition	Date	How obtained
Residual Urine in the Saline Bladder. By David Newman, M.D.		1917	Library Grant.
Hints for R.A.M.C. Officers. By Ramcorps		1918	,, ,,
Medical Diseases of the War. By A. F. Hurst, M.A., M.D.	2nd	1918	,, ,,
Fractures of the Orbit. By Felix Lagrange. Edited by J. H. Parsons		1918	,, ,,
The Chemistry of Bread-making. By James Grant, M.Sc.Tech.	2nd	1917	,, ,,
Studies in Blood-pressure. By George Oliver, M.D. ..	3rd	1916	,, ,,
An Inquiry into the Analytical Mechanism of the External Ear. By Sir T. Wrightson, Bart.		1918	,, ,,
Hysterical Disorders of Warfare. By L. R. Yealland, M.D.		1918	,, ,,
Amputation Stumps, their Care and After-Treatment. By G. M. Huggins, F.R.C S.		1918	,, ,,
Bipp Treatment of War Wounds. By Rutherford Morison		1918	,, ,,
Gymnastic Treatment for Joint and Muscle Disabilities. By Bt.-Col. H. E. Deane, R.A.M.C.		1918	,, ,,
Applied Bacteriology. Edited by C. H. Browning, M.D.		1918	,, ,,
Vaccines and Sera in Military and Civilian Practice. By A. G. Shera, B.A., M.D.		1918	,, ,,
An Introduction to Bacteriological and Enzyme Chemistry. By Gilbert J. Fowler, D.Sc.		1911	,, ,,
The Medical Annual		1918	,, ,,
The Edinburgh School of Surgery before Lister. By A. Miles		1918	,, ,,
Sketches of the East Africa Campaign. By Capt. R. V. Dolbey, R.A.M.C.		1918	,, ,,
British Campaigns in Flanders, 1690-1794. By the Hon. J. W. Fortescue		1918	,, ,,
Proceedings of the Medical Association of the Isthmian Canal Zone, January, 1917, to June, 1917. Vol. x. Part 1		1918	Editor, Journal.
Port of Sydney, N.S.W., Official Handbook	2nd	1913	,, ,,
Guy's Hospital Reports. Vol. lxix		1918	,, ,,
St. Thomas's Hospital Reports. New Series. Vol. xliv..		1918	,, ,,
A Check List of the Literature and other Material in the Library of Congress on the European War. Compiled under the direction of Herman H. B. Meyer		1918	,, ,,
University of London. The Calendar for the year 1918-1919		1918	,, ,,
Medical Research Committee. An Atlas of Gas Poisoning		1918	Medical Research Committee.
Medical Research Committee. Statistical Reports. No. 2—Gunshot Wound; Compound Fracture of Femur, and Penetration of Hip and Knee Joints		1918	,, ,,
Reports of the Chemical Warfare Medical Committee:—			
No. 12—Treatment of Patients suffering from "Effort Syndrome" by Continuous Inhalation of Oxygen. August		1918	,, ,,
No. 9—Tissue Changes in Animals produced by Pulmonary Irritant Gases. September		1918	,, ,,
No. 10—The Administration of Oxygen in Irritant Gas Poisoning. October		1918	,, ,,
No. 11—Investigations of Chronic Cases of Gas Poisoning. October		1918	,, ,,
No. 13—Bleeding after Poisoning by Pulmonary Irritant Gases. With Appendices. November		1918	,, ,,
No. 15—The Later Effects of Irritant Gas Poisoning. November		1918	,, ,,
Medical Research Committee. Reports of the Air Medical Investigation Committee. No. 4—Temperament and Service Flying. September		1918	,, ,,

LIST OF BOOKS ADDED TO THE LIBRARY—*Continued.*

Title of Work and Author	Edition	Date	How obtained
Medical Research Committee. Reports of the Special Investigation Committee on Surgical Shock and Allied Conditions—			
No. 6. Memorandum on Blood Volume after hæmorrhage. By Capt. D. H. Robertson, M.R.C., and Capt. A. V., M.R.C., U.S.A. August		1918	Medical Research Committee.
No. 7. Acidosis and Shock. October		1918	,, ,,
National Heart Insurance. Fourth Annual Report of the Medical Research Committee, 1917—1918		1918	,, ,,
Trench Fever. Report of Commission Medical Research Committee American Red Cross		1918	Presented by Major R. P. Strong, U.S.A.
Journal of the Royal Naval Medical Service, October ..		1918	Editor, Journal.
R.A.M.C. Magazine, October 4 to December 27		1918	,, ,,
Die Rotation der Wange. Von Dr. J. F. S. Esser ..			War Office, A.M.D. 2.

Royal Army Medical College,
January 9, 1919.

DEMOBILIZATION OF THE CANADIAN CORPS.

OFFICIAL STATEMENT.

THE Ministry of the Overseas Military Forces of Canada has authorized the following statement from Lieut.-Gen. Sir Arthur Currie, G.C.M.G., Commanding the Canadian Corps as to the demobilization of the Canadian Troops in France :—

As long as the Corps constitutes part of a larger military organization, such as an army of occupation, it must remain a fully organized unit from a military point of view.

For that reason it is impossible to demobilize any part of it in a manner which involves men being withdrawn for any other consideration than a military one. If men were withdrawn on account of length of service, occupation, etc., it is conceivable that all administrative services of the Corps would break down, and the Corps become immobile. These services are made up in many instances of men who have been withdrawn to a particular service after long experience in the firing line.

Therefore it follows that to make ready any part of the Corps for demobilization you must set aside a complete unit. As the Division is the tactical unit, it has been considered wise to demobilize the Corps by Divisions, and for the purpose of discipline it is essential to retain them intact.

The principle governing the demobilization of a Division is that the men should be sent home by units, in order that the organization under which they have been controlled, supplied and fought, should remain in existence as long as possible. It is believed that men will arrive in Canada happier and more contented, and with discipline better maintained if the unit organization is adhered to until the last possible moment.

When asked to nominate the order of return of units, the Corps Commander recommended that they be demobilized in the order in which they were formed, viz. : First, second, third and fourth. For that reason the first and second divisions were sent to the Rhine first, because at that time it was the intention that all Canadian divisions should go to Germany; and if the first and second went first they could later on be relieved by the third and fourth, after which they would be moved to the base and there got ready for demobilization.

On account of factors governing the military situation it was not found possible to send the third and fourth divisions to Germany, and as it was impossible to relieve either the first or the second by either the third or the fourth it became necessary to nominate either the third or the fourth as the division to be demobilized first.

For a similar reason to that which governed the first nomination, the Corps Commander recommended the third division to be demobilized first, to be followed by the first, second and fourth in the order named. A certain proportion of corps troops and troops on the lines of communication will accompany the divisional troops to Canada.

There are so many members of the Canadian Corps who were originally resident in the British Isles, and who wish to see again relatives and parents before they return to Canada, that more applications for leave to England were received than could be granted. Cordially sympathizing with this desire on the part of the men, and in order that all might be treated on the same basis, it was found that the only possible way in which to meet the wish of the men was that the divisions should be returned to Canada via England. This has been arranged.

A free issue of twenty-five reprints will be made to contributors of Original Communications, and of twenty-five excerpts of Lectures, Travels and Proceedings of the United Services Medical Society.

Any demand for reprints, additional to the above, or for excerpts, must be forwarded at the time of submission of the article for publication, and will be charged for at the following rates, and additional copies at proportionate rates:—

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	16	0 8 3	0 3 11				
	4	0 3 4	0 1 5				
25	8	0 6 0	0 2 9	4 10	1 6	4 4	0 11
	16	0 10 6	0 5 0				
	4	0 4 6	0 1 10				
50	8	0 7 6	0 3 6	6 0	2 1	4 10	1 2
	16	0 13 3	0 5 10				
	4	0 6 0	0 3 1				
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	16	0 18 6	0 7 6				
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Cases for Binding Volumes.—Strong and useful cases for binding can be obtained from the publishers at the undermentioned rates:—

Covers, 2s. 6d. net; binding, 2s. 6d.

These charges are exclusive of cost of postage.

In forwarding parts for binding the name and address of sender should be enclosed in parcel.

The above figures are subject to 25 per cent increase.

All Applications for Advertisements to be made to—

G. STREET & CO., Ltd., 8, Serle Street, London, W.C.

The back outside cover is not available for advertisements.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are

inserted free of charge to subscribers and members of the Corps. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS," 324, Adastral House, Victoria Embankment, E.C. 4.

The following publications have been received:—

British: The Hospital, St. Bartholomew's Hospital Journal, Public Health, Transactions of the Society of Tropical Medicine and Hygiene, Proceedings of the Royal Society of Medicine, Edinburgh Medical Journal, The Journal of State Medicine, The Medical Press, Tropical Diseases Bulletin, Guy's Hospital Gazette, The Journal of Tropical Medicine and Hygiene, Bulletin of Entomological Research, The Medical Journal of South Africa, Tropical Veterinary Bulletin, The Indian Medical Gazette, Journal of the Royal Naval Medical Service, The British Journal of Tuberculosis.

Foreign: Archives de Médecine et Pharmacie Navales, Bulletin of the Johns Hopkins Hospital, The Military Surgeon, War Medicine, United States Public Health Service, Le Caducée, Giornale di Medicina Militare, Bulletin de la Société de Pathologie Exotique, Surgery, Gynæcology and Obstetrics, Bulletin de l'Institut Pasteur.

MANAGER'S NOTICES.

The JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is published monthly, six months constituting one volume, a volume commencing on 1st July and 1st January of each year.

The Annual Subscription is £1 (which includes postage), and should commence either on 1st July or 1st January; but if a subscriber wishes to commence at any other month he may do so by paying for the odd months between 1st July and 1st January at the rate of 1s. 8d. (one shilling and eightpence) per copy. (All subscriptions are payable in advance.)

Single copies can be obtained at the rate of 2s. per copy.

The Corps News is also issued separately from the Journal, and can be subscribed for at the rate of 2s. (two shillings) per annum, including postage. Subscriptions should commence from 1st July each year; but if intending subscribers wish to commence from any other month, they may do so by paying for the odd months at the rate of 2d. per copy. (All subscriptions are payable in advance.)

Officers of the Royal Army Medical Corps possessing Diplomas in Public Health, etc., are kindly requested to register their special qualifications at the War Office. Letters of complaint are frequently received from officers stating that their special qualifications have not been shown in the Distribution List which is published as a supplement to the Journal in April and October of each year. As, however, the particulars of this list are supplied from official sources, officers are reminded that unless the possession of Diplomas, etc., has been registered at the War Office, no entry of such qualifications can be recorded in the Distribution List.

Letters notifying change of address should be sent to the Hon. Manager, "Journal of the Royal Army Medical Corps," 25, Adastral House, Victoria Embankment, E.C. 4, and must reach there not later than the 20th of each month for the alteration to be made for the following month's issue.

It is requested that all Cheques or Postal Orders for Subscriptions to the Journal, Corps News, Reprints, etc., be crossed "Holt & Co.," and made payable to the "Hon. Manager, Journal R.A.M.C.," and not to any individual personally.

All communications for the Hon. Manager regarding subscriptions, etc., should be addressed to

THE HON. MANAGER,
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EXCHANGES, &c.

The charge for inserting Notices respecting Exchanges in the Royal Army Medical Corps is 5/- for not more than five lines, which should be forwarded by Cheque or P.O.O., with the notice, to Messrs. G. STREET and CO., Ltd., 8, Serle Street, London, W.C., not later than the 22nd of the month.

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

March, 1919.

EXTRACTS FROM THE "LONDON GAZETTE."

War Office,
January 7, 1919.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for distinguished services rendered during the course of the campaign:—

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

Decorations and Medals conferred by the President of the French Republic.

Légion d'Honneur.

Croix de Guerre.

Major Henry d'Arnim Blumberg, Royal Army Medical Corps (Territorial Force), attached Royal Engineers.

Brevet-Major Lancelot Gerard Bourdillon, D.S.O., M.C., Royal Army Medical Corps.

Capt. Elmer John Dickinson, M.C., Canadian Army Medical Corps, attached 1st Motor Machine-gun Brigade.

Temp. Capt. (Acting Major) Daniel McKelvey, M.C., M.B., Royal Army Medical Corps.

Capt. Gilbert William Rogers, M.C., M.B., Royal Army Medical Corps (Territorial Force).

Temp. Capt. (Acting Major) Harold Bedford George Russell, Royal Army Medical Corps.

Capt. (Acting Lieut.-Col.) George Pritchard Taylor, D.S.O., M.C., M.B., Royal Army Medical Corps.

Capt. (Acting Major) Arthur Peregrine Thomson, M.C., Royal Army Medical Corps (Territorial Force).

Major Frederick Lawrence Wall, M.C., 7th Field Ambulance, Australian Army Medical Corps.

Croix de Guerre, avec Palme.

Col. Robert James Blackham, C.M.G., C.I.E., D.S.O., M.D., F.F.P.S., Army Medical Service.

Croix de Guerre.

457006 Pte. (Acting Cpl.) William Finnimore, Royal Army Medical Corps, attached 24th Field Ambulance (Exeter).

337280 Cpl. (Acting Serjt.) Bertram Douglas Lloyd, 2/1st West Lancs. Field Ambulance, Royal Army Medical Corps (Llandysilio, near Llanymuneck, S.O.)

2929 Pte. Duncan McCallum, Royal Army Medical Corps, attached 2/1st Wessex Field Ambulance (Stirling).

478208 Lance-Cpl. (Acting Cpl.) Horace John Youngs, Royal Army Medical Corps, attached 1/2nd Wessex Field Ambulance (Ipswich).

War Office,
January 10, 1919.

The names of the undermentioned have been brought to the notice of the Secretary of State for War for devotion to duty and valuable services rendered by them when prisoners of war, during epidemics of cholera and typhus fever at the Prisoners of War Camp at Wittenberg, Germany:—

ROYAL ARMY MEDICAL CORPS.

Capt. S. Field (since deceased).
Major W. B. Fry (since deceased).
Lieut. (Temp. Capt., Acting Major) J. la F. Lauder, D.S.O., M.C.
Major H. E. Priestley, C.M.G.
Capt. A. A. Sutcliffe (since deceased).
Major A. C. Vidal, D.S.O.

War Office,
January 16, 1919.

His Majesty the King has been graciously pleased to approve of the award of the Distinguished Conduct Medal to the undermentioned Non-commissioned Officers and Men, for gallantry and distinguished service in the Field :—

1263 Pte. A. W. Bird, No. 11 Field Ambulance, Royal Army Medical Corps (Bow).

For conspicuous gallantry and devotion to duty from August 30 to September 3, 1918, east of Arras. He worked continuously under heavy shell fire evacuating wounded, being wounded, buried by a shell, and later on gassed, and although vomiting for two hours, carried on with his work. He set a fine example of endurance to the other bearers.

100514 Pte. J. Brown, No. 10 Field Ambulance, Royal Army Medical Corps (Oldham).

For conspicuous gallantry and devotion to duty. During night operations on September 1/2, 1918, east of Arras, the medical officer of the regiment was killed and the regimental stretcher-bearer wounded. He took over the care and evacuation of the wounded, collecting many himself, under shell fire, and establishing a R.A.P., where he attended to them. His resource and initiative saved much suffering and many lives.

38657 Serjt. L. Gillies, M.M., 99th Field Ambulance, Royal Army Medical Corps (Lochgelly).

For conspicuous gallantry and devotion to duty near Villers Guislain from September 19 to 27, 1918, when for eight days he continuously superintended the clearance of wounded. On the afternoon of September 20, during a heavy barrage, he assisted in bringing in a wounded officer, showing indomitable courage and energy.

2904 Cpl. (Acting Serjt.) G. Mossop, M.M., 14th Field Ambulance, Royal Army Medical Corps (Birmingham).

For conspicuous gallantry and devotion to duty near Cambrai from September 18 to 30, 1918. In charge of bearers he went up time after time by day and night to the R.A.P.s through heavy shell fire. He was indefatigable in collecting bearers from all sources, bringing up ambulances in pitch darkness and rain across open country and in doing all that was humanly possible to alleviate the sufferings and ensure the speedy evacuation of the wounded.

495412 Serjt. W. A. Nowers, M.M. (Canterbury), and 495422 Cpl. (Acting Lance-Serjt.) L. G. Craft, M.M., 2/2nd (H.C.) Field Ambulance, Royal Army Medical Corps (Territorial Force), (Folkestone).

While acting as stretcher serjeants near Maricourt from August 24 to September 3, 1918, these non-commissioned officers displayed great energy and courage, carrying on their work without any relief. They went forward on August 24 to Happy Valley, and cleared many wounded under intense shell fire, several men being hit at the time. Again, under heavy shell fire they carried in three seriously wounded men, who could not be got at for twenty-four hours on account of the shelling. They both set a magnificent example throughout.

120082 Pte. W. E. Spradbury, 36th Field Ambulance, Royal Army Medical Corps (Walthamstow).

For conspicuous gallantry and devotion to duty near Mametz on August 26, 1918. He accompanied an officer when rescuing one officer and three men of an infantry battalion under very heavy machine-gun fire. One of the party was killed, two were wounded, and two other men got bullets through their clothing. Notwithstanding this he, with his squad, after bringing in the first party of wounded, returned under heavy machine-gun fire and brought in a non-commissioned officer who was wounded.

CANADIAN FORCE.

530111 Serjt. A. L. R. Davidson, 208th Field Ambulance, Canadian Army Medical Corps.

This non-commissioned officer was continuously in the field from August 8 to 13, 1918, near Domart and Bouchoir, searching for, collecting and dressing wounded. He displayed great courage in unhesitatingly carrying out his duty under heavy shell and machine-gun fire. On August 12 he led his squad several times into a wood, part of which was held by the enemy, and successfully brought out several stretcher cases. His fine example and willingness to undertake the most dangerous and hard tasks were of great assistance to his medical officer.

530669 Pte. (Acting Lance-Cpl.) F. C. Norton, No. 9 Canadian Field Ambulance, Canadian Army Medical Corps.

During the fighting east of Arras, August 26 to 28, as junior non-commissioned officer in charge of bearers, he cleared cases under very heavy machine-gun and artillery fire for three days continuously. On the night of August 28, 1918, he cleared wounded from Bois pu Sart, Jigsaw Wood and Boiry area, under intense artillery fire, and he played three different groups of bearers out, but had his own area cleared over ground which was almost impassable even in daytime for carrying stretchers. His leadership of his men and disregard of his own safety were at all times a magnificent example for his men and saved many men's lives.

529631 Staff-Serjt. W. A. Scott, No. 10 Canadian Field Ambulance, Canadian Army Medical Corps.

During the fighting east of Arras August 26 and 28, 1918, he was on continuous duty directing the stretcher-bearers during the whole period of recent operations. Owing to the rapid advance he was frequently left in charge of the bearers, as the officer in charge had to reconnoitre and move his posts forward from time to time. During all this period this non-commissioned officer led his men and directed the clearing of the wounded from the central sector. His absolute fearlessness under heavy shell and machine-gun fire, his disregard of personal danger, and the example he set to his men of energy and cheerfulness in most arduous circumstances was responsible for the collection and rapid evacuation of the wounded.

War Office,
January 18, 1919.

His Majesty the King has been graciously pleased to approve of the award of the Meritorious Service Medal to the following Warrant Officers, Non-Commissioned Officers and Men, in recognition of valuable services rendered with the Armies in France and Flanders:—

ROYAL ARMY MEDICAL CORPS.

43914 Serjt.-Major T. Davies, 111th Field Ambulance (Swansea).
61210 Serjt.-Major T. Donelly, St. John's Ambulance Brigade Hospital (Poulton-le-Fylde).
27009 Temp. Serjt.-Major T. Francis, 38th Casualty Clearing Station (Ynysybwl).
41557 Serjt.-Major P. P. Jones, 52nd Field Ambulance (Birmingham).
53244 Serjt.-Major W. J. Lane, 17th Casualty Clearing Station (Burton-on-Trent).
18439 Serjt.-Major W. T. Leach, 2nd Casualty Field Ambulance (Hawick).
30581 Serjt.-Major J. W. Lockwood, 43rd Field Ambulance (East Ham).
34417 Serjt.-Major F. H. Ruse, 49th Field Ambulance (Stoke).
14290 Serjt.-Major W. H. Scott-Badcock, 2nd Casualty Clearing Station (Westbourne Park).
37267 Serjt.-Major H. B. Shelton, 55th Field Ambulance (Leeds).
16265 Serjt.-Major P. T. Simes, 1st Casualty Clearing Station (Hythe).
36588 Serjt.-Major T. Simpson, 34th Field Ambulance (Stourbridge).
15437 Serjt.-Major C. A. Wilkinson, 6th Field Ambulance (Bromley).
408013 Qmr.-Serjt. P. S. Beard, 42nd Motor Ambulance Convoy (Leeds).
388053 Qmr.-Serjt. (Temp. Serjt.-Major) J. A. Brennan, 2/2nd Northern Field Ambulance (Darlington)
49688 Qmr.-Serjt. S. Cooper, 73rd Field Ambulance (Portland).
527005 Qmr.-Serjt. K. B. Cragg, 21st Sanitary Section (Croydon).
301230 Qmr.-Serjt. (Temp. Serjt.-Major) W. T. J. Davis, 2/1st High. Field Ambulance (Peterhead).
437365 Qmr.-Serjt. S. E. Foss, 2/2nd (South Midland) Field Ambulance (Broadway).
405375 Qmr.-Serjt. G. Fowler, 2/3rd (West Riding) Field Ambulance (Sheffield).
12261 Qmr.-Serjt. (Acting Serjt.-Major) J. E. Green, 17th Field Ambulance (Dublin).
423001 Qmr.-Serjt. (Temp. Serjt.-Major) S. C. Greenwood, 53rd Casualty Clearing Station (Leicester).
497231 Qmr.-Serjt. (Temp. Serjt.-Major) J. H. Hawksworth (Ripon).
90454 Qmr.-Serjt. A. Hay, 105th Field Ambulance (E.) Margate).
57996 Qmr.-Serjt. T. C. Hill, 141st Field Ambulance (Harrington).
17210 Qmr.-Serjt. (Acting Serjt.-Major) C. E. James, 5th Stationary Hospital (Grimsby).
17485 Qmr.-Serjt. (Acting Serjt.-Major) H. Kennedy, No. 1, Stationary Hospital (Portsmouth).
37855 Qmr.-Serjt. J. M. Lees, 59th Field Ambulance (Oldham).
318002 Qmr.-Serjt. D. MacDonald, 1/2nd Low. Field Ambulance (Dennistoun).
12266 Qmr.-Serjt. (Temp. Serjt.-Major) H. Parker, 93rd Field Ambulance (Margate).
20698 Qmr. Serjt. (Acting Serjt.-Major) G. Rothwell, 18th Field Ambulance (Bolton).
15483 Qmr.-Serjt. (Temp. Serjt.-Major) E. Sharp, 10th Stationary Hospital (Coventry).
90466 Qmr.-Serjt. (Temp. Serjt.-Major) G. R. Smith, 44th Casualty Clearing Station (Brighton).
30147 Qmr.-Serjt. (Acting Serjt.-Major) C. Summers, 106th Field Ambulance (Horndean).
17928 Qmr.-Serjt. (Acting Serjt.-Major) W. S. Toye, 62nd Casualty Clearing Station (Millbank).
32001 Qmr.-Serjt. (Temp. Serjt.-Major) T. McD. Weldon, 3rd Low Field Ambulance (Edinburgh).
13317 Qmr.-Serjt. C. F. Wheeler, 12th Stationary Hospital (Rochester).
19812 Serjt. F. P. Barron (Kilburn, N.W.).
40446 Serjt. (Acting Company Serjt.-Major) H. O. Benham, 19th Division (Hove).
298 Serjt. (Acting Staff-Serjt.) D. M. S. Bentley, L. of C. (Portland).
341593 Serjt. R. S. Berry, 65th Field Ambulance (Blackpool).
34724 Staff-Serjt. W. Bone, 3rd Casualty Clearing Station (Newton-de-Willows).
19916 Staff-Serjt. (Acting Serjt.-Major) H. J. Carroll, 33rd Casualty Clearing Station (Tidworth).
33764 Staff-Serjt. (Acting Qmr.-Serjt.) A. G. Champion, Headquarters, 9th Division (Hampstead, N.W.).

17501 Staff-Serjt. (Acting Serjt.-Major) J. Christie, 83rd General Hospital (Cork).
412002 Staff-Serjt. L. H. Clarke (York).
73468 Serjt. I. H. David, 45th Casualty Clearing Station (E.) Cardiff).
403173 Serjt. W. T. Disbrey, 2/2nd West Riding Field Ambulance (Leeds).
35682 Serjt. A. England, 53rd Field Ambulance (Alfreton).
461447 Serjt. F. W. F. Epworth, 2/3rd Wessex Field Ambulance (Nottingham).
421042 Serjt. D. Fellows, 1/3rd (North Midland) Field Ambulance (Wolverhampton).
538019 Staff-Serjt. A. Franklin, 6th London Field Ambulance (Delabole).
528205 Staff-Serjt. S. B. B. Franks, 1st Sanitary Company (Brixton Hill, S.W.).
48010 Staff Serjt. (Acting Qmr.-Serjt.) S. C. Garrett, 129th Field Ambulance (Haverfordwest).
495191 Staff-Serjt. P. W. Glover, 2nd Home Command Field Ambulance (Althorne).
38595 Staff-Serjt. (Acting Qmr.-Serjt.) F. D. Grahame, 75th Field Ambulance (Margate).
47244 Serjt. H. J. H. Groves, 19th Casualty Clearing Station (Upper Norwood, S.E.).
935 Staff-Serjt. (Acting Qmr.-Serjt.) H. M. Griffith-Williams (West Hayes).
527007 Serjt. (Acting Staff-Serjt.) A. Guthrie, 9th Sanitary Section (Stockwell).
403183 Serjt. T. A. Hamer, 2/2nd (West Riding) Field Ambulance (Leeds).
11834 Serjt. G. W. Hillier, 5th Casualty Field Ambulance (Brighton).
31591 Staff-Serjt. (Acting Qmr.-Serjt.) W. Hopkins, 27th Field Ambulance (Peckham, S.E.).
63912 Serjt. (Acting Staff-Serjt.) D. Jeffreys, 91st Field Ambulance (Ystradgynlais).
54078 Serjt. (Acting Qmr.-Serjt.) W. Keighley, Headquarters, 17th Division (Wimborne).
16482 Staff-Serjt. (Acting Qmr.-Serjt.) W. C. Leppington, 54th Army Transport (Scarborough).
305005 Staff-Serjt. T. F. MacDougall, 1/3rd High. Field Ambulance (Dundee).
51297 Serjt. R. McCurdy, 109th Field Ambulance (Belfast).
545982 Serjt. T. H. Merck, 2nd London Sanitary Company (Wimbledon Park).
37548 Staff-Serjt. G. D. Middleton, 14th Field Ambulance (Burton).
386024 Staff-Serjt. R. Monkhouse, 1/1st Northern Field Ambulance (Newcastle-on-Tyne.
403033 Staff-Serjt. (Temp. Serjt.-Major) H. L. Moss, 2nd West Riding Field Ambulance (Leeds).
67172 Serjt. W. Nicholson, 96th Field Ambulance (Orrell).
37178 Serjt. A. Pollard, 24th General Hospital (Hallam Fields).
68898 Serjt. (Acting Qmr.-Serjt.) B. Prime, 95th Field Ambulance (Kenilworth).
14402 Staff-Serjt. J. W. Ranford, 12th Ad. Department of Medical Stores (Aldershot).
17714 Staff-Serjt. (Acting Qmr.-Serjt.) A. R. Robinson, 14th Field Ambulance (Oxford).
18655 Staff-Serjt. (Acting Serjt.-Major) F. Shepley, 36th Casualty Clearing Station (Scarborough).
473132 Serjt. F. Sneesby, 88th (1st East Anglian) Field Ambulance (Bury St. Edmunds).
4302 Serjt. (Acting Qmr.-Serjt.) H. Steer, 9th Casualty Field Ambulance (South Farnborough).
512191 Staff-Serjt. (Acting Qmr.-Serjt.) W. H. Stevens, 3rd London Field Ambulance (Golder's Green, N.W.).
25355 Serjt. W. G. Stunnell, 49th Casualty Clearing Station (Thornton Heath).
441088 Staff-Serjt. C. I. Thacker, S.M. Casualty Clearing Station (Lowestoft).
66563 Serjt. W. E. Thornhill, 99th Field Ambulance (Dawlish).
12987 Staff-Serjt. (Acting Serjt.-Major) B. Walter (Chiswick).
34364 Staff-Serjt. C. H. Warne, 45th Field Ambulance (Newington Causeway).
441033 Staff-Serjt. H. Wilmore, 56th Casualty Clearing Station (West Bromwich).
341205 Staff-Serjt. (Acting Qmr.-Serjt.) I. Wolfe, 3rd West Lancashire Field Ambulance (St. Helens).
401144 Serjt. F. D. Wood, 1st West Riding Field Ambulance (Knaresboro').
354295 Cpl. (Acting Serjt.) J. H. Alsop, 1/3rd East Lancashire Field Ambulance (Manchester).
65833 Cpl. (Acting Serjt.) W. T. Battersby, 103rd Field Ambulance (Seascale).
386272 Cpl. (Acting Serjt.) J. Bentham, 1st Northern Field Ambulance (Leeds).
54560 Cpl. (Acting Serjt.) R. E. Bevan-Brown, 8th Mob. Laboratory (Plymouth).
441158 Cpl. H. Brook, 11, Motor Ambulance Convoy (Huddersfield).
53592 Cpl. (Acting Serjt.) S. Cairns, 10th Field Ambulance (Jedburgh).
44623 Cpl. (Acting Serjt.) W. D. Campbell, 35th Field Ambulance (Sunderland).
52572 Cpl. (Acting Serjt.) E. Cheesman, 23rd Casualty Clearing Station (Fence Woodhouse).
5946 Cpl. (Acting Serjt.) J. Clarkson, 8th Field Ambulance (Fleetwood).
19783 Cpl. W. J. Clayden, 5th Field Ambulance (Aylesbury).
60468 Cpl. (Acting Serjt.) H. Cook, 13th Casualty Clearing Station (Brigg).
38360 Cpl. (Acting Serjt.) H. T. Dartnall, 13th Motor Ambulance Convoy (Cheltenham).
57848 Cpl. W. F. Dobson, Headquarters, 25th Division (Manchester).
53674 Cpl. (Acting Qmr.-Serjt.) H. Duke, Headquarters, 37th D. Division (Hastings).
545661 Cpl. (Acting Lance-Serjt.) H. Elkington (Lee, S.E.).
4955 Cpl. (Acting Serjt.) J. Forrest, 16th Field Ambulance (Lanark).
65692 Cpl. (Acting Serjt.) F. Fowler, 104th Field Ambulance (Brentwood).
527144 Cpl. S. Hands, 6th Sanitary Section (Edgware).
51286 Cpl. (Acting Serjt.) T. R. Harvey, Advance Depot Medical Service, 20th Division (New Barnet).
545372 Cpl. M. M. Heather, N. (Winchester).

5989 Cpl. J. Holmes, 3rd Field Ambulance (Blakeney).
527579 Cpl. (Acting Serjt.) E. A. Hunting, 1st London Sanitary Company (Stanford le-Hope).
337219 Cpl. (Acting Qmr.-Serjt.) A. P. Ireland, 87th (1/1st W. Lancashire) Field Ambulance (Rhosneigr).
38820 Cpl. (Acting Serjt.) F. Kay, 47th Field Ambulance (Woodhouse).
6775 Cpl. (Acting Serjt.) S. J. Kidman, 3rd B.D. Medical Stores (Portslade).
401003 Cpl. (Acting Serjt.) F. Pawson, 1st West Riding Field Ambulance (Cookridge).
538270 Cpl. (Acting Qmr.-Serjt.) R. J. Robertson, 6th London Field Ambulance (Torquay).
343132 Cpl. (Lance-Serjt.) R. E. Seely, 34th Casualty Clearing Station (Lincoln).
545387 Cpl. S. Smith, 42nd Sanitary Section (Salford).
403389 Cpl. G. H. Squire, 2/2nd (West Riding) Field Ambulance (Leeds).
461408 Cpl. (Acting Serjt.) L. Taylor, 3rd West Field Ambulance (Southampton).
61794 Cpl. (Acting Serjt.) T. Taylor, 90th Field Ambulance (Hadfield).
162 Cpl. (Acting Qmr.-Serjt.) H. E. H. Thatcher, 33rd Casualty Clearing Station (Swindon).
411135 Cpl. T. Thompson, 108th Field Ambulance (Belfast).
4826 Cpl. (Acting Serjt.) W. H. Wheeler (London).
337493 Pte. A. R. Athey, 1st West Lancashire Field Ambulance (Kensington).
77066 Pte. (Acting Lance-Cpl.) J. Baker, 4th Mobile X-ray Unit (Washington).
411 Pte. (Acting-Serjt.) C. G. Bowden, 19th Field Ambulance (Seaforth).
493364 Pte. H. Bramley, 2/1st (H.C.) Field Ambulance (Offham).
50291 Pte. R. R. Bright (Guilden Down).
308054 Pte. (Acting Staff-Serjt.) A. Cameron, 1/2nd High. Field Ambulance (Fochabers).
70612 Pte. (Acting Lance-Serjt.) F. Capper, 138th Field Ambulance (Crewe).
508238 Pte. F. W. Charman, 2/1st London Field Ambulance (Bury St. Edmunds).
42316 Pte. (Acting Serjt.) A. Conway, 7th Field Ambulance (Darton).
27943 Pte. A. Dickinson, 29th Casualty Clearing Station (Cleckheaton).
7347 Pte. (Acting Cpl.) A. J. Friend, 1/1st North Midland Field Ambulance (Maidstone).
34813 Pte. (Acting Lance-Cpl.) B. Garrett, 20th Casualty Clearing Station (Overton).
47709 Pte. (Acting Serjt.) J. G. Gillard, 1st Sanitary Section (Abbots Leigh).
49452 Pte. G. H. Goatley, 74th Field Ambulance (Thornton Heath).
37736 Pte. (Acting Cpl.) H. J. Griffiths, 50th Field Ambulance (Emscote).
75961 Pte. (Acting Serjt.) W. G. W. Hawkes, 137th Field Ambulance (Finsbury Park, N.).
48859 Pte. R. C. Hughes, 130th Field Ambulance (Rhiwlas).
545456 Pte. (Lance-Serjt.) H. Inchley, 2nd London Sanitary Company (Rotherham).
341579 Pte. N. Kenyon (Blackpool).
543979 Pte. (Acting-Serjt.) A. Kerton (Blackfriars).
6504 Pte. W. Langlois, 43rd Casualty Clearing Station (Guernsey).
20416 Pte. (Acting Staff-Serjt.) G. Laws, 2nd Field Ambulance (Gateshead).
448055 Pte. (Acting Serjt.) E. Longbottom, 31st S.M.D., Sanitary Section (Smethwick).
3741 Pte. (Acting Cpl.) W. McArthur, 15th Brigade Ambulance (Johnshaven).
54323 Pte. (Acting Serjt.) F. Morrison, 110th Field Ambulance (Moycullen).
545165 Pte. (Acting Cpl.) W. Newman, 56th Sanitary Section (Streatham).
20385 Pte. (Acting Serjt.) F. E. Nunn, 12th Field Ambulance (Bristol).
9589 Pte. F. M. Pallant, 8th Casualty Clearing Station (Swancombe).
102513 Pte. (Acting Lance-Cpl.) A. Pasquill, 5th Casualty Clearing Station (Tyldesley).
58236 Pte. E. W. Perry, 5th Field Ambulance (Kentish Town).
11802 Pte. (Acting Serjt.) F. Richardson, 21st Casualty Clearing Station (York).
403475 Pte. F. Rogers (Leeds).
72266 Pte. G. Seamons, 134th Field Ambulance (St. Lawrence).
42018 Pte. (Acting Lance-Cpl.) P. Stewart, 10th Casualty Clearing Station (Rutherglen).
2293 Pte. O. H. Stowe, 13th Field Ambulance (London, S.E.).
90485 Pte. H. M. Watson (Helensburgh).
53651 Pte. (Acting Serjt.) H. S. Websdale, 6th Mob. Laboratory (Hastings).

War Office,
January 22, 1919.

The following dispatch has been received by the Secretary of State for War from General Sir E. H. H. Allenby, G.C.B., G.C.M.G., Commander-in-Chief, Egyptian Expeditionary Force:—

General Headquarters,
October 23, 1918.

My Lord,—I have the honour to forward herewith a list of Officers and other ranks whom I consider worthy of mention for their services during the period from March 16, 1918, to September 18, 1918.

I have the honour to be, my Lord,
Your Lordship's most obedient servant,
(Signed) E. H. H. Allenby,
General, Commanding-in-Chief,
Egyptian Expeditionary Force.

Commands and Staff

Temp. Major (Acting Lieut.-Col.) J. J. Abraham, D.S.O., M.D., F.R.C.S., Royal Army Medical Corps.
Temp. Capt. (Acting Lieut.-Col.) W. Angus, M.D., Royal Army Medical Corps.
Capt. J. Chalmers, M.B., Royal Army Medical Corps (Territorial Force).
Col. E. J. R. Evatt, D.S O., M.B., Royal Army Medical Corps (Territorial Force).
Lieut.-Col. (Acting Col.) C. Garner, C.B.E., M.B., R.P.
Capt. and Brevet Major (Temp. Major) A. S. M. MacGregor, M.D., Royal Army Medical Corps (Territorial Force).
Capt. (Temp. Major) P. A. Opie, M.B., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) E. P. Sewell, C.M.G., D.S.O., M.B., Royal Army Medical Corps.

Army Medical Service and Royal Army Medical Corps.

Capt. (Temp. Lieut.-Col.) A. G. Coullie, M.B., F.R.C.S.E.
Capt. D. L. Graham, O.B.E., M.B.
Major (Temp. Lieut.-Col.) E. C. Hodgson, D.S.O.
Lieut.-Col. P. S. Lelean, C.B., F.R.C.S.
Temp. Lieut. K. R. Madan, O.B.E.
Temp. Capt. R. H. Astbury, M.B.
Temp. Capt. C. H. Burgess, M.B.
Lieut. (Temp. Capt.) W. M. Cameron, M.B., attached 2nd Battalion Royal Highlanders
Temp. Major J. P. Campbell, M.B.
Temp. Capt. J. Cardin
Temp. Capt. J. Chambre, M.D., attd. R.A.F.
Temp. Col. C. C. Choyce, C.B.E., M.D., F.R.C.S.
Temp. Capt. F. H. Diggle, O.B.E., M.B., F.R.C.S.
Major (Acting Lieut-Col.) W. F. Ellis, O.B.E.
Temp. Capt. W. W. Forbes, O.B.E.
Temp. Qmr. and Lieut. E. H. Gann.
Temp. Capt. N. S. Gilchrist, O.B.E., M.D., attached R.A.F.
Temp. Lieut. E. Gofton, M.B., attached No. 24 Ind. Clearing Hospital.
Temp. Capt. E. G. Goldie, M.D., attached 127th Ind. Combined Field Ambulance
Temp. Qmr. and Lieut. W. Greaves.
Temp. Capt. W. F. Hawkins, M.B.
Capt. T. F. Kennedy, O.B.E., M.B.
Major (Acting Lieut.-Col.) W. E. C. Lunn, M.C., M.B.
Capt. (Acting Major) W. Mathieson.
Temp. Qmr. and Lieut. J. C. McGown.
Capt. J. T. Simson, M.B., attd. Egyptian Army
Temp. Capt. C. W. Smith, O.B.E., M.B., F.R.C.S.
Temp. Capt. (Acting Major) E. B. Smith, M.D.
Temp. Capt. (Acting Major) W. H. D. Smith, M B., attd. 127th Combined Field Ambulance
Capt. B. H. H. Spence, M.B., attached Egyptian Army
Lieut.-Col. G. E. F. Stammers, O.B.E.
Temp. Capt. J. A. H. Telfer, M.B.
Temp. Qmr. and Lieut. E. J. Trafford.
12651 Staff-Serjt. (Acting Serjt.-Major) R. H. Bennett
46733 Serjt. J. Boag
67092 Pte. J. J. Conlon. (Died).
4551 Pte. (Acting Serjt.) W. A. Cook
75271 Cpl. (Acting Serjt.) E. H. Evans
545441 Pte. (Acting Cpl.) H. W. Franks
17128 Serjt. F. G. Fuller
36402 Staff-Serjt. (Acting Serjt.-Major) C. Gooding
9784 Serjt. (Acting Serjt.-Major) H. Hathaway
59802 Cpl. (Acting Staff-Serjt.) A. Hilton
318344 Qmr.-Serjt. (Temp. Serjt.-Major) J. F. Macfarlane
59572 Serjt. (Acting Qmr.-Serjt.) H. J. Martin, attached No. 45 Ind. General Hospital
14326 Qmr.-Serjt. (Temp. Serjt.-Major) W. P. S. Norman
14609 Qmr.-Serjt. (Temp Serjt.-Major) W. P. Oldridge
31101 Staff-Serjt. (Acting Qmr.-Serjt.) J. G. Palmer
33316 Cpl. (Acting Serjt.) S. Pett, attached 154th Ind. Combined Field Ambulance
12402 Staff-Serjt. (Acting Serjt.-Major) T. E. Rondel, D.C.M.
44078 Pte. W. Schofield
1861 Serjt. J. C. R. Simmons, attached 165th Ind. Combined Field Ambulance
22108 Qmr.-Serjt. W. Stewart
26506 Cpl. (Acting Lance-Serjt.) A. P. Tawton
18318 Serjt. E. G. Thomas, attached Egyptian Army
18040 Staff-Serjt. W. Toothill, attached Ind. Convalescent Depot
76970 Serjt. (Acting Staff-Serjt.) J. H Worthington, attached 137th Ind. Staty. Hosp.

Royal Army Medical Corps (Special Reserve).

Capt. H. W. Evans, M.C., M.B.
Capt. D. Fraser, M M., M.B., attached 137th Ind. Stationary Hospital.
Capt. (Temp. Lieut.-Col.) P. S. Vickerman, O.B.E., M.B., F.R.C.S.
Capt. O. Williams, attached 112th Ind. Combined Field Ambulance.

Royal Army Medical Corps (Territorial Force).

Major L. A. Avery, D.S.O., attached Gloucester Yeomanry (Territorial Force).
Capt. R. Briercliffe, O.B.E., M.B.
Capt. C. Douglas, M.B.
Major W. Dyson, O.B.E., M.D.

Major (Acting Lieut.-Col.) J. Evans, D.S.O., M.D.
Major F. Gracie, O.B.E., M.B.
Qmr. and Capt. A. Hall.
Capt. Inglis, J., O.B.E.
Lieut. H. Jessop.
Qmr. and Capt. G. J. Leask.
Capt. G. J. Linklater, M.B.
Capt. (Temp. Major) W. C. Macaulay, M.B.
Major (Acting Lieut.-Col.) J. W. Mackenzie, O.B.E., M.D.
Capt. J. M. Mitchell, M.C., M.B.
Capt. (Acting Major) L. M. V. Mitchell, O.B.E., M.B.
Capt. (Temp. Major) R. Phillips, M.D.
Capt. (Acting Major) G. B. Pritchard.
Major G. C. Taylor, O.B.E., M.D.
Major A. Thomas, M.B., attached R.F.A. (T.F.).
Major F. B. Treves, O.B.E., M.B.
Capt. (Acting Major) A. P. Watson, O.B.E., M.D., F.R.C.S.
545687 Staff-Serjt. F. T. Back, attached 80th Sanitary Section.
534314 Serjt. H. T. Blake, attached 121st Ind. Combined Field Ambulance.
536184 Serjt. A E. Bourne, attached 160th Ind. Combined Field Ambulance.
324005 Serjt..H. F. Deas, 2nd Sco. General Hospital, attached 4th Stationary Hospital.
323025 Pte. (Acting Staff-Serjt) S. Dempster.
366017 Qmr.-Serjt. J. C. Hanna, 1/2nd Welsh Field Ambulance, attached Headquarters, 53rd Division.
473399 Pte. (Acting Cpl.) W. G. Meacham, 2/1st E. Ang. Field Ambulance, attached No. 6 Mil. Laboratory.
480003 Serjt W. C. Miller, 54th Division Sanitary Section.
527458 Serjt. (Acting Staff.Serjt.) R. Phillips, 91st Sanitary Section.
533062 Cpl. (Acting Staff-Serjt.) W. J. Ralph.
536173 Serjt. E. D. Regan, attached 160th Ind. Combined Field Ambulance.
368001 Temp. Serjt.-Major F. T. Rowe, 1/3rd Welsh Field Ambulance.
444005 Qmr. Serjt. (Temp. Serjt.-Major) B. Rusling.
364003 Qmr..Serjt. (Temp. Serjt.-Major) W. C. Scott, 1/1st Welsh Field Ambulance.
354344 Serjt. A. Seed.
545008 Qmr.-Serjt. L. Skeeles, 114th Sanitary Section.
366050 Serjt. C. A. Ward, 2nd Welsh Field Ambulance.

INDIAN ARMY.

Lieut.-Col. (Temp. Col.) W. H. Ogilvie, C.M.G., M.B., Indian Medical Service.

War Office,
January 24, 1919.

His Majesty the King has been graciously pleased to approve of the award of a Second Bar to the Military Medal to the undermentioned Non-Commissioned Officer :—

SECOND BAR TO MILITARY MEDAL.

45610 Serjt. J. B. Hyde, M.M., 104th Field Ambulance, Royal Army Medical Corps (Toddington), (M.M. gazetted August 23, 1916 ; 1st Bar gazetted August 29, 1918).

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Military Medal to the undermentioned Non-Commissioned Officers and man :—

BAR TO MILITARY MEDAL.

41546 Serjt. P. Higginson, M.M., 52nd Field Ambulance, Royal Army Medical Corps (Chester), (M.M. gazetted October 21, 1916).
2029 Serjt. F. Robinson, M.M., 23rd Field Ambulance, Royal Army Medical Corps (Strood). (Italy). (M.M. gazetted March 12, 1917).
50215 Pte. J. Keaty, M.M., 104th Field Ambulance, Royal Army Medical Corps (Cork).
41869 Serjt. (Acting Staff-Serjt.) B. E. Radford, M.M., 50th Field Ambulance, Royal Army Medical Corps (Bridgwater).

MILITARY MEDAL.

Royal Army Medical Corps.

38001 Staff-Serjt. (Acting Qmr.-Serjt.) H. R. Alexander, 54th Field Ambulance (Bowes Park).
26785 Staff-Serjt. S. R. Sargant, 1st (London) Field Ambulance (Bishopston).
512228 Staff-Serjt. W. A. Watkins, 3rd (London) Field Ambulance (Crowley Down).
512196 Serjt. (Temp. Serjt.-Major) H. E. Young, 3rd (London) Field Ambulance (Brockley).
65728 Serjt. A. R. Foy, 102nd Field Ambulance (Amberley, near Stroud).
17520 Serjt. C. Good, 48th Field Ambulance (Cornwall).

35369 Serjt. J. S. Paterson, 55th Field Ambulance (Stockwell).
37249 Serjt. J. Rattray, 51st Field Ambulance (Perth).
54029 Serjt. E. C. Stimpson, 38th Field Ambulance (Lower Edmonton).
435131 Cpl. (Acting Lance-Serjt. J. E. Aldridge, 1st (S.M.) Field Ambulance (Birmingham). (Italy.)
38637 Cpl. (Acting Serjt.) T. C. Evans, 49th Field Ambulance (Ferndale).
439624 Cpl. C. A. Martin, 3rd (S M.) Field Ambulance (Cardiff). (Italy.)
65432 Cpl. J. Gigner, 104th Field Ambulance (Fulham).
439046 Cpl. W. Powell, 3rd (S.M.) Field Ambulance (Bristol).
31965 Pte. A. E. Baker, 49th Field Ambulance (Nuneaton).
510195 Pte. A. J. Batchelor, 2nd (London) Field Ambulance (Islington).
512405 Pte. (Acting Lance-Cpl.) A. E. Bevan, 3rd (London) Field Ambulance (Norwich).
38350 Pte. P. Cartwright, 54th Field Ambulance (Lichfield).
508270 Pte. F. Cassidy, 1st (London) Field Ambulance (Shepherd's Bush).
101134 Pte. S. Clark, 142nd Field Ambulance (Earby).
79363 Pte. R. E. Davies, 142nd Field Ambulance (Liverpool).
33782 Pte. (Acting-Serjt.) T. J. Davies, 45th Field Ambulance (Penyffordd).
512520 Pte. C. W. L. De Souza, 3rd (London) Field Ambulance (Stamford Hill).
65497 Pte. C. A. V. Emerson, 103rd Field Ambulance (Bishop's Stortford).
512541 Pte. H. E. English, 3rd (London) Field Ambulance (Muswell Hill).
1582 Pte. J. W. Feasey, 142nd Field Ambulance (Hull).
10068 Pte. E. Fox, 23rd Field Ambulance (Lochgelly). (Italy.)
65324 Pte. (Acting-Serjt.) A. W. Frosdick, 104th Field Ambulance (Norwich).
1676 Pte. F. Goodge, 27th Field Ambulance (Folkestone).
67315 Pte. I. Grace, 97th Field Ambulance (Liverpool).
417491 Pte. W. Hardy, 1st (North Midland) Field Ambulance (Duffield).
37850 Pte. F. J. Hartwell, 52nd Field Ambulance (Birmingham).
36146 Pte. E. Hastilow, 21st Field Ambulance (Aldridge). (Italy.)
48151 Pte. (Acting Lance-Cpl.) W. J. Kendall, 130th Field Ambulance (Pontnewynydd).
339160 Pte. (Acting Lance-Serjt.) A. Kemp (Liverpool).
32833 Pte. A. E. Lindsay, attd. R.F A. (Camden Road). (Salonika.)
8977 Pte. C. Marr, 54th Field Ambulance (Oakenshaw).
67111 Pte. J. Moran, 96th Field Ambulance (Blackburn).
77790 Pte. D. T. Morgan, 142nd Field Ambulance (Carmarthen).
39452 Pte. P. H. Outram, 38th Field Ambulance (Tenby).
8717 Pte. G. Parsons, 21st Field Ambulance (Martock). (Italy.)
497184 Pte. W. Pearce, 104th Field Ambulance (Addlestone).
8112 Pte. W. Petre, 38th Field Ambulance (Beamish).
48563 Pte. J. Phillips, 130th Field Ambulance (Abertillery).
419307 Pte. (Acting Lance-Cpl.) E. Pladgeman, 2nd (North Midland) Field Ambulance (Leicester).
417330 Pte. S. Fountain, 1st (North Midland) Field Ambulance (Derby).
34224 Pte. (Acting Lance-Cpl.) J. W. Read, 142nd Field Ambulance (Stratford).
62393 Pte. E. R. Roberts (St. Helens). (Salonika.)
35161 Pte. F. Roche, 142nd Field Ambulance (Liverpool).
301085 Pte. C. Taylor, 89th (1st Highland) Field Ambulance (Territorial Force), (Aberdeen).
42821 Pte. H. Thomson, 49th Field Ambulance (Linlithgow).
135230 Pte. E. A. H. Turner, 50th Field Ambulance (Kegworth).
301335 Pte. J. Walker, 89th (1st Highland) Field Ambulance (Territorial Force), (Aberdeen).
536457 Pte. C. F. White, 1st (London) Field Ambulance (Kensington).
38378 Pte. G. Wolstencroft, 55th Field Ambulance (Oldham).

War Office,
January 29, 1919.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for distinguished services rendered during the course of the campaign :—

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

DECORATIONS CONFERRED BY THE PRESIDENT OF THE FRENCH REPUBLIC.

Légion d'Honneur.
Croix de Chevalier.

Temp. Capt. (Acting Lieut.-Col.) James Robertson Campbell Greenless, D.S.O., M.B., Royal Army Medical Corps.

Croix de Guerre.

403534 Pte. Herbert Dellar, 1/2nd (West Riding) Field Ambulance, Royal Army Medical Corps (Territorial Force), (Bradford).

343069 Serjt. (Temp. Serjt.-Major) James Leighton, 34th Casualty Clearing Station, Royal Army Medical Corps (Territorial Force), (Kendal, Westmorland).

Médaille Militaire.

86566 Pte. Robert M. Boyd, 38th Casualty Clearing Station, Royal Army Medical Corps, (Beith).

4212 Cpl. Albert Edward Cooper, Royal Army Medical Corps, attached 3rd Brigade, Royal Garrison Artillery.

Médaille d'Honneur, avec Glaives (en Vermeil).

527010 Qmr.-Serjt. Samuel Percy Bristow, No. 1 Sanitary Section, Royal Army Medical Corps (Highgate, N.).

Médaille d'Honneur, avec Glaives (en Argent).

19595 Staff-Serjt. (Acting Serjt.-Major) Charles Edward Bull, Royal Army Medical Corps, attached Director of Medical Services Fourth Army (Camberley).

540004 Serjt Clarence Samuel Johnson, 54th Casualty Clearing Station, Royal Army Medical Corps (Territorial Force), (New Southgate, N.).

74724 Pte. (Acting Staff-Serjt.) Fred William Mercer, Royal Army Medical Corps, attached Headquarters, 3rd Army (Birmingham).

45818 Pte. Graham Bell, 19th Casualty Clearing Station, Royal Army Medical Corps (Ladybank, Fifeshire).

9115 Pte. William Thomas Blewitt, 8th Casualty Clearing Station, Royal Army Medical Corps (Aughton, near Sheffield).

21143 Pte. Edward Cecil, 3rd Cavalry Field Ambulance, Royal Army Medical Corps (Openshaw, Manchester).

5812 Pte. John Duncan, 19th Field Ambulance, Royal Army Medical Corps (Falkirk).

341406 Pte. Thomas Holt, 64th Field Ambulance (2/3rd West Lancashire Field Ambulance), Royal Army Medical Corps (Territorial Force), (St. Helens).

528116 Pte. (Acting Serjt.) Leonard Astin Marshall, 48th Sanitary Section, Royal Army Medical Corps (Bury).

14896 Pte. Robert Ritchie, No. 2 Cavalry Field Ambulance, Royal Army Medical Corps (Downpatrick, Co. Down).

Médaille des Epidémies (en Vermeil).

Major (Acting Lieut.-Col.) Ralph Bignell Ainsworth, D.S.O., Royal Army Medical Corps.

Major (Temp. Lieut.-Col.) John Frank Crombie, D.S.O., Royal Army Medical Corps (Territorial Force).

Capt. Francis Henry Guppy, Royal Army Medical Corps (Special Reserve).

Major (Acting Lieut.-Col.) Edward Michael O'Neill, D.S.O., M.B., Royal Army Medical Corps.

Temp. Capt. Robert McCheyne Paterson. Royal Army Medical Corps.

Capt. (Acting Major) Frank Herbert Cheney Watson, M.B., Royal Army Medical Corps (Territorial Force).

Capt. William Thomas Wood, Royal Army Medical Corps (Territorial Force).

Capt. (Acting Lieut.-Col.) Henry Neville Burroughes, M.B., Royal Army Medical Corps (Territorial Force).

Capt. (Acting Major) Sydney James Clegg, M.B., Royal Army Medical Corps (Territorial Force).

Temp. Capt. Ronald Montague Handfield-Jones, M.C., Royal Army Medical Corps.

Capt. Alfred George Hebblethwaite, D.S.O., Royal Army Medical Corps (Territorial Force).

Capt. William Hugh Hill, M.D., Royal Army Medical Corps (Territorial Force).

Capt. (Acting Major) Alfred Morgan Hughes, Royal Army Medical Corps (Territorial Force).

Temp. Capt. Lancelot Raoul Lempriere, M.B., Royal Army Medical Corps.

Capt. James McLean Macfarlane, M.C., M.D., Royal Army Medical Corps (Territorial Force).

Temp. Capt. Octavius de Burgh Marsh, M.B., Royal Army Medical Corps.

Capt. Thomas Jenkins Murray, Royal Army Medical Corps (Territorial Force).

Capt. (Acting Major) John Hawkes Pendered, M.C., M.B., F.R.C.S., Royal Army Medical Corps.

Temp. Capt. Arthur Francis Savory Sladden, M.D., Royal Army Medical Corps.

Temp. Capt. Alfred Edward Stevens, M.D., Royal Army Medical Corps.

Capt. Eric Stuart Taylor, M.B., Royal Army Medical Corps (Territorial Force).

46211 Pte. Michael Clarke, 66th Field Ambulance, Royal Army Medical Corps (Crossgates, Fife).

War Office,
January 30, 1919.

The following dispatch has been received by the Secretary of State for War from Lieut.-Gen. Sir G. F. Milne, K.C.B., K.C.M.G., D.S.O., Commander in Chief, British Salonika Force:—

General Headquarters, Salonika.
November 1, 1918.

My Lord,—I have the honour to submit herewith a list of the names of the Officers, Warrant Officers, and Men, whose services I desire to bring to your Lordship's notice for gallant conduct and distinguished services rendered during the period from March 1 to October 1, 1918.

I have the honour to be, my Lord,
Your Lordship's most obedient Servant,
G. F. Milne, *Lieut.-Gen.*,
Commanding-in-Chief, British Salonika Force.

COMMANDS AND STAFF.

Major (Temp. Lieut.-Col.) J. A. Anderson, M.B., Royal Army Medical Corps.
Col. E. T. F. Birrell, C.B., C.M.G., M.B., Army Medical Service.
Col. H. J. M. Buist, C.M.G., D.S.O., M.B., Army Medical Service.
Capt. (Acting Major) W. F. Christie, M.B., Royal Army Medical Corps.
Lieut.-Col. (Acting Col.) T. E. Fielding, D.S.O., M.B., Royal Army Medical Corps.
Major W. R. Galwey, O.B.E., M.C., M.B., Royal Army Medical Corps.
Lieut.-Col. J. E. Hodgson, O.B.E., Royal Army Medical Corps (died).
Major and Brevet Lieut.-Col. (Temp. Col.) C. W. Holden, D.S.O., Royal Army Medical Corps.
Major-Gen. M. P. C. Holt, K.C.M.G., C.B., D.S.O., Army Medical Service.
Capt. (Acting Major) N. V. Lothian, M.C., M.B., Royal Army Medical Corps.
Lieut.-Col. C. B. Martin, C.M.G., M.B., Royal Army Medical Corps.
Lieut.-Col. and Brevet Col. (Temp. Col.) W. H. S. Nickerson, V.C., C.M.G., M.B., Royal Army Medical Corps.

ARMY MEDICAL SERVICE.

Temp. Col. L. S. Dudgeon, C.M.G., F.R.C.P.
Temp. Col. R. E. Kelly, C.B., M.D., F.R.C.S. (Capt. and Brevet Major, Royal Army Medical Corps (Territorial Force)).
Temp. Col. A. G. Phear, C.B., M.D., F.R.C.P.

ROYAL ARMY MEDICAL CORPS.

Temp. Capt. (Acting Major) A. G. Anderson, M.D.
Temp. Capt. D. I. Anderson, O.B.E., M.B.
Temp. Capt. J. C. M. Bailey, O.B.E., M.D.
Temp. Capt. (Acting Major) G. V. Bakewell, O.B.E., M.B.
Temp. Capt. V. J. Bonavia, M.D.
Lieut.-Col. M. Boyle, O.B.E., M.B.
Temp. Capt. M. S. Bryce, M.C., M.B.
Qmr. and Lieut. (Temp. Major) W. H. Butler.
Temp. Capt. (Acting Major) S. Campbell, M.B.
Temp. Capt. L. Cassidy, M.B., F.R.C.S.I.
Temp. Capt. A. H. Coleman, O.B.E., M.B.
Temp. Capt. J. A. Delmege, O.B.E.
Temp. Capt. R. R. Elworthy, O.B.E., M.D.
Temp. Capt. C. Y. Flewitt, M.B.
Temp. Capt. G. O. Hempson.
Temp. Capt. (Acting Major) J. V. Holmes, M.B.
Temp. Capt. N. E. Kendall.
Temp. Capt. F. Newey, M.B.
Temp. Capt. J. L. H. Paterson, M.B.
Temp. Capt. (Acting Major) W. H. Peacock, M.B.
Temp. Capt. W. Thomas.
Lieut.-Col. A. D. Waring, M.B.
Temp. Capt. J. Warnock, M.D.
Temp. Capt. J. S. Webster, M.B.
Temp. Lieut.-Col. C. M. Wenyon, C.M.G., M.B.
Temp. Capt. H. O. West, M.D.
Temp. Capt. E. C. White, M.B.
100815 Pte. (Acting Cpl.) A. Allen.
57440 Pte. C. Allen.
47128 Serjt. A. J. Asplin.
76435 Pte. L. P. Astridge.
40201 Pte. (Acting Lance-Cpl.) A. Bamber.
62206 Cpl. (Acting Qmr.-Serjt.) W. J. Bedwell.
55331 Staff-Serjt. T. Beeley.
105946 Pte. (Acting Lance-Cpl.) A. K. Beer.
30133 Serjt. E. G. Berry.
100382 Pte. A. Boardwell.
43209 Serjt. S. Buckley.
21221 Pte. (Acting Lance-Cpl.) L. Budden.
65513 Pte. H. Capon.
106482 Pte. (Acting Serjt.) C. Carr.
69333 Acting Serjt. G. C. Channon.
26695 S. M. N. Chetwood.
88876 Pte. C. L. Cook.
14465 Qmr.-Serjt. (Temp. Serjt.-Major) R. Cottey.
41420 Staff-Serjt. G. A. Davies.
92735 Pte. M. E. Davies.
64301 Temp. Serjt.-Major J. D. Doig.
968 Serjt. (Acting Staff-Serjt.) R. E. Fairweather.
64112 Serjt. J. Finnie.
26227 Staff-Serjt. F. W. Fletcher.
25528 Pte. (Acting Lance-Cpl.) T. Freeman.
7160 Pte. S. Gale.
105438 Pte. (Acting Cpl.) S. H. D. George.
26710 Serjt. (Acting Staff-Serjt.) P. Griffiths.
12052 Staff Serjt. (Acting Serjt.-Major) F. C. Halkett.
57446 Pte. (Acting Cpl.) J. E. Hardcastle.
40793 Pte. J. Hazley.
60268 Pte. W. B. Hourston.
62229 Pte. (Acting Lance-Cpl.) D. Hunt.
38185 Serjt. W. J. Jack.
5052 Serjt. J. W. Jepp.
79335 Cpl. (Acting Serjt.) W. Kampff.
1544 Pte. (Acting Lance-Cpl.) F. Kirk.
57766 Pte. H. Lockwood.
105336 Pte. W. Long.
63136 Pte. W. Marsh.
49482 Pte. (Staff-Serjt.) J. H. Martin.
5535 Pte. (Acting Cpl.) C. H. Masters.
37929 Cpl. R. R. Miller.
16573 Serjt.-Major R. S. Nichol.
53208 Pte. (Acting Lance-Cpl.) T. V. Oliver.
4343 Serjt. (Acting Qmr.-Serjt.) W. S. Parr.
51650 Cpl. (Acting Serjt.) J. W. Phillips.
63085 Pte. (Acting Serjt.) J. E. Raw.
79406 Serjt. H. F. Rome.
42864 Pte. L. Rosen.
19515 Staff-Serjt. G. D. Salter.
59877 Qmr.-Serjt. F. H. Simmons.
1866 Serjt. W. Sugden.
61179 Pte. (Acting Cpl.) W. Thairlwall.
18933 Qmr.-Serjt. (Temp. Serjt.-Major) H. L. Thompson.
79552 Pte. (Acting Serjt.) E. G. Thorn.
78394 Serjt. H. V. Tidman.
63623 Cpl. W. D. Vaughan.
23365 Cpl. (Acting Serjt.) H. Waddington.
32689 Pte. R. Walker.
60220 Pte. W. Webb.
40885 Serjt. R. G. Williams.
8120 Qmr.-Serjt. (Acting Serjt.-Major) V. C. Woodcock.

Royal Army Medical Corps (Special Reserve.)

Capt. (Acting Major) T. Y. Barkley, O.B.E., M.B.
Capt. R. D. Cameron.
Capt. (Acting Major) W. B. Foley, O.B.E., M.B.
Capt. A. G. Harsant.
Capt. G. M. Hetherington, M.B.
Capt. H. E. McColl, O.B.E., M.B.
Capt. (Acting Major) R. McKinlay, M.B.
Capt. W. O. F. Sinclair, M.B.

Royal Army Medical Corps (Territorial Force).

Capt. G. L. Findlay, M.B., 3rd (London) Field Ambulance.
Major (Temp. Lieut.-Col.) J. Gray, O.B.E.
Capt. T. S. Hele, M.D., 1st (H.C.) Field Ambulance.
Capt. A. M. Jones.
Qmr. and Capt. J. Keogh, 3rd (H.C.) Field Ambulance.
Major (Acting Lieut.-Col.) A. E. Kidd, M.B., 3rd (High.) Field Ambulance.
Qmr. and Capt. A. J. H. Knights, T.D., 2nd (London) Field Ambulance.
Capt. (Acting Major) J. C. Marklove, 3rd (H.C.) Field Ambulance.
Lieut.-Col. P. Mitchell, O.B.E., M.D., 1st Sco. General Hospital.
Capt. (Acting Lieut.-Col.) R. P. Nash, 2nd Eastern General Hospital.
Capt. (Temp. Lieut.-Col.) J. Patrick, M.B., F.R.C.S., 3rd Sco. General Hospital.
Capt. (Acting Major) H. A. Playfair-Robertson, 1st (H.C.) Field Ambulance.
Capt J. Steedman, M.B., 3rd (Northumberland) Field Ambulance.
Capt. (Acting Major) W. D. Sturrock, D.S.O., M.D.
Capt. (Acting Major) J. Taylor, O.B.E., F.R.C.S., 3rd (London) Field Ambulance.
Lieut.-Col. F. E. A. Webb, O.B.E., 1st Eastern General Hospital.
497145 Serjt. H. Badland, 3rd (H.C.) Field Ambulance.
527172 Cpl. R. W. D. Beckett, 1st (London) Field Ambulance.
388449 Cpl. W. J. Eales, 2nd (Northumberland) Field Ambulance.
508168 Pte. H. E. Fitzpatrick, 1st (London) Field Ambulance.
497027 Serjt. A. Garrett, 3rd (H.C.) Field Ambulance.
493002 Staff-Serjt. (Acting Regimental Serjt.-Major) A. E. Grant, 1st (H.C.) Field Ambulance.
493730 Pte. (Acting Cpl.) W. T. Hames, 1st (H.C.) Field Ambulance.
388215 Serjt. (Acting Qmr.-Serjt.) T. Hinson, 2nd (Northumberland) Field Ambulance.
545674 Pte. (Acting Cpl.) M. Jones, 2nd (London) Sanitary Company.
545781 Pte. (Acting Lance-Cpl.) H. R. Leaver, 2nd (London) Sanitary Company.
545604 Staff-Serjt. J. W. Manser, 2nd (London) Sanitary Company.
510265 Serjt. J. H. Mitchell, 2nd (London) Field Ambulance.
386012 Qmr.-Serjt. (Temp. Serjt.-Major) J. Murray, 1st (Northumberland) Field Ambulance.
324017 Serjt. R. Nicholson, 2nd Scottish General Hospital.
495192 Cpl. (Acting Serjt.) B. Owers, 2nd (H.C.) Field Ambulance.
528141 Cpl. (Acting Staff-Serjt.) E. F. Patton, 1st (London) Sanitary Company.
536478 Qmr.-Serjt. (Temp. Serjt.-Major) H. E. Pierce, 5th (London) Field Ambulance.
465010 Qmr.-Serjt. (Temp. Serjt.-Major) E. Pillar, 4th Southern General Hospital.
527689 Cpl. (Acting Serjt.) H. T. Privett, 1st London Sanitary Company.
510153 Serjt. J. Ridge, 2nd (London) Field Ambulance.
324031 Pte. (Acting Serjt.) W. Rodger, 2nd Scottish General Hospital.
545627 Cpl. (Acting Serjt.) J. R. Rogers, 2nd (London) Sanitary Company.
493179 Staff-Serjt. F. H. Rowcroft, 1st (H.C.) Field Ambulance.
533065 Cpl. (Acting Staff-Serjt.) F. Sharp, 1st (London) Mounted Brigade Field Ambulance.
497056 Pte. W. A. Skilton, 2nd (H.C.) Field Ambulance.
512031 Cpl. (Acting Serjt.) A. A. Slade, 3rd (London) Field Ambulance.
528026 Pte. (Acting Serjt.) J. A. Syms, 1st (London) Sanitary Company.
512011 Serjt, W. F. Taylor, 3rd (London) Field Ambulance.
493438 Pte. H. J. Templeman, 1st (H.C.) Field Ambulance.
388158 Cpl. W. Tennick, 2nd (Northumberland) Field Ambulance.
386391 Serjt. J. G. Williams, 1st (Northumberland) Field Ambulance.

War Office,
January 30, 1919.

His Majesty the King has been graciously pleased to approve of the award of the Meritorious Service Medal to the following Warrant Officers, Non commissioned Officers and Men in recognition of valuable services rendered with the British Forces in Salonika.

Royal Army Medical Corps.

39861 Serjt.-Major T. Davey, 29th General Hospital (Rochester).
390001 Qmr.-Serjt. (Acting Serjt.-Major) R. W. Edwards, 3rd Northumberland Field Ambulance (Hull).
26422 Qmr.-Serjt. E. J. Maiden 27th Casualty Clearing Station (Halesowen).

26735 Qmr.-Serjt. (Acting Serjt.-Major) W. Otterson, 37th General Hospital (Lancaster).
30834 Staff-Serjt. (Acting Qmr.-Serjt.) J. E. Bailey, Reserve Battalion (Walton-on-Thames).
19396 Staff.-Serjt. H. Baker, 12th B.D.M.S. (Canning Town).
40919 Serjt. G. R. Batsford, 40th Casualty Clearing Station (Belfast).
16481 Staff-Serjt. (Acting Qmr.-Serjt.) W. W. Bee, 32nd M.A.C. (Belfast).
497002 Staff-Serjt. W. F. Bosley, 3rd H.C. Field Ambulance (Richmond).
56787 Serjt. (Acting Qmr.-Serjt.) N. Brown, 27th Division (Grimsby).
493018 Serjt. H. Duncan, 1st H. C. Field Ambulance (Chatham).
11372 Serjt. E. J. Green, 31st Casualty Clearing Station (Plumstead).
388218 Serjt. F. R. Jackson, 2nd Northumberland Field Ambulance (New Shildon).
78644 Serjt. (Acting Serjt.-Major) E. W. King, 42nd General Hospital (Niton, Isle of Wight).
39447 Serjt. (Acting Qmr.-Serjt.) P. Le Lacheur, 68th Field Ambulance (Fulham).
30545 Serjt. M. J. Mordecai, 67th Field Ambulance (Stoke Newington).
19046 Serjt. (Acting Staff-Serjt.) S. J. Phillips, 78th Field Ambulance (East Hertford).
24355 Staff-Serjt. D. S. Roberts, 29th General Hospital (Liverpool).
512030 Serjt. G. Stewart, 3rd London Field Ambulance (Newton Stewart).
1308 Cpl. (Acting Qmr.-Serjt.) A. Bunker, 106th Field Ambulance (Plymouth).
79349 Cpl. (Acting Serjt.), H. H. Frankham, Base Lab., South Lambeth.
105942 Pte. (Acting Serjt.) A. Ashton, 143rd Field Ambulance (Chorley).
24217 Pte. F. Barlow, 29th General Hospital (Bolton).
56496 Pte. H. Huntley, 18th Stationary Hospital (Brandon Village).
79751 Pte. (Acting Serjt.) W. J. Mugleton, 52nd General Hospital (Cambridge).
68971 Pte. (Acting Lance-Serjt.) J. W. Straw, 25th Casualty Clearing Station (Ilkeston).

War Office,
January 31, 1919.

The following dispatch has been received by the Secretary of State for War from Lieutenant-General Sir. J. L. Van Deventer, K.C.B., C.M.G., Commanding-in-Chief, East African Force:—

General Headquarters,
September 30, 1918.

MY LORD,—I desire to record my appreciation of the excellent services rendered by the Officers, Warrant Officers, Non-commissioned Officers and Men included in the list I am forwarding with this dispatch, during the period from December 1, 1917, to July 31, 1918.

I have the honour to be, My Lord,
Your Lordship's obedient servant,
J. L. VAN DEVENTER,
Commanding-in-Chief.
East African Force.

ROYAL ARMY MEDICAL CORPS.

Capt. D. C. Buchanan, M.B. (Special Reserve).
Temp. Capt. C. E. Clay.
Temp. Capt. H. M. Fisher.
Temp. Capt. T. J. H. Hoskin.
Temp. Capt. C. R. Howard (died).
Major (Acting Lieut.-Col.) R. E. Humfrey, M.B.
Temp. Capt. Q. Madge.
Temp. Capt. L. R. H. P. Marshall, M.D.
Temp. Lieut.-Col. H. B. G. Newham, M.D.
Temp. Major R. Semple, M.D.
Temp. Capt. E. W. L. Sharp.
Temp. Major R. Standish-White, F.R.C.S.I., attached North Rhodesian Medical Corps.
19620 Staff-Serjt. (Acting Serjt.-Major) W. J. Carter.
59705 Cpl. C. Conquest.
67890 Serjt. S. S. Easter.
93922 Serjt. S. Jeeves.
33153 Serjt. (Acting Serjt.-Major) R. E. Lake.
52429 Serjt. G. W. May.
92309 Pte. (Acting Serjt.) A. McArthur.
103152 Pte. (Acting Serjt.) H. G. Pearce.
106352 Pte. W. H. Smith.
41797 Pte. A. E. Ward.
105040 Pte. H. Waterworth.

War Office,
February 1, 1919.

His Majesty the King has been graciously pleased to approve of the following awards to the undermentioned Officers and Warrant Officers in recognition of their gallantry and devotion to duty in the field:—

AWARDED A BAR TO THE DISTINGUISHED SERVICE ORDER.

Major (Temp. Lieut.-Col.) David Ahern, D.S.O., No. 11 Field Ambulance, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty from August 30 to September 3, 1918, during operations on the Arras front. He was responsible for the clearing of casualties from the divisional front. He showed great forethought in selecting sites for his forward posts, especially in establishing one post in a village which proved of the utmost value as an A.D.S. later on. He was wounded while at his work, but refused to leave until the conclusion of operations. His energy and resource were instrumental in the prompt evacuation of the wounded. (D.S.O. gazetted June 4, 1917.)

Capt. (Acting Lieut.-Col.) Alexander Donald Fraser, D.S.O., M.C., No 9 Field Ambulance, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He was in charge of bearer divisions during the operations in the neighbourhood of Moyenneville—Ervillers—St. Leger from August 21 to August 28, 1918, and was continually among the leading troops under heavy shell and machine-gun fire directing the evacuation of wounded from R.A.P.s. He managed to get ambulance cars close up to the firing line, which greatly accelerated the clearing of casualties to the rear. He was untiring throughout the whole period and set a fine example to those under him. (D.S.O., gazetted June 4, 1917.)

Major (Acting Lieut.-Col.) Charles Roade Munroe Morris, D.S.O., M.B., 99th Field Ambulance, Royal Army Medical Corps.

For exceptional gallantry and devotion to duty on September 20 to 24 south-west of Villers Guislain, in working continually for five days under heavy shell fire, supervising and co-ordinating the work of the medical officers while at work at night in the advanced dressing station. It was twice blown in by shell burst. He carried out important surgical work, and by his pluck and endurance set a fine example to all around him. (D.S.O., gazetted June 4, 1917.)

AWARDED THE DISTINGUISHED SERVICE ORDER.

Temp. Capt. (Acting Major) Hugh Ross Macintyre, M.C., M.D., Royal Army Medical Corps, attached 69th Field Ambulance (Italy).

For conspicuous gallantry and devotion to duty during operations on the Piave between October 27 and 29, 1918, especially on the morning of the 27th when in charge of stretcher bearers. He crossed to the right bank of the Piave immediately behind the infantry under very heavy fire, and supervised the collection and evacuation of the wounded under great difficulties, having to ford the river several times. He set a very fine example to all under him by his untiring energy and total disregard for his own safety.

Temp. Capt. (Acting Major) Philip Randal Woodhouse, M.C., M.B., 9th Field Ambulance, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty in command of a bearer division. On September 27, 1918, at Maison Rouge, when loading wounded on an ambulance wagon, it was damaged, and an ammunition dump close by set on fire by heavy shelling. He at once got the fire out, and evacuated the wounded to safety. On two other occasions he did good work under heavy shell fire, clearing a road which was blocked by a tree blown across it, and also in evacuating wounded when his A.D.S. was hit by a shell.

Canadian Force.

Lieut.-Col. William Harold Kerr Anderson, 13th Field Ambulance, Canadian Army Medical Corps.

During the operations before Arras, September 25, he was in charge of the evacuation of wounded. He succeeded in keeping in close touch with the infantry during the whole of the battle, so that the wounded were evacuated almost as soon as they became casualties. His duties were often performed under enemy artillery fire which caused many casualties, but by his courage and personal example he kept his men at their splendid work until all casualties were carried out.

Major (Acting Lieut.-Col.) William Alfred Gordon Bauld, No. 7 Canadian Cavalry Field Ambulance, Canadian Army Medical Corps.

For conspicuous gallantry and devotion to duty during mounted operations from October 8 to 11, 1918. He was in command of the advanced cavalry field ambulances. On the night of October 9 to 10, when ordered to search and clear the wounded from three villages, which were being heavily shelled, and the approaches badly damaged by craters, he organized the evacuation of the wounded, making certain that all were found and removed. He showed great coolness and energy.

Major George William Hall, 12th Field Ambulance, Canadian Army Medical Corps.

For conspicuous gallantry and devotion to duty during the action in front of Arras; from September 2 to 6 he was in charge of the evacuation of wounded. Time and time again he went through heavy enemy shell and machine-gun fire to direct the clearing of the wounded. On the afternoon of September 2 he succeeded in clearing a number of wounded who were being shelled with gas shell to a place of safety, and dressed many wounded under heavy fire. His work throughout the battle was admirable.

Australian Imperial Force.

Major Donald Dunbar Coutts, Australian Army Medical Corps, attached 24th Battalion, Australian Imperial Force.

On September 1, 1918, during the attack at Mont St. Quentin, although the R.A.P. was consistently shelled, he attended the wounded almost continuously for fifty-two hours, during five of which he was forced to wear his gas respirator, displaying throughout the greatest courage and devotion to duty. On the day prior to the attack a shell burst on a dug-out, wounding several

men and pressing one down, severely wounded, blocking the entrance. He immediately went forward regardless of intense shell fire, and succeeded in extricating the man and removing him over exposed ground to the rear.

Capt. Patrick Joseph Francis O'Shea, M.C., Australian Army Medical Corps, attached 8th Battalion, Australian Infantry.

For conspicuous gallantry and devotion to duty near Chuignes on August 23, 1918. Keeping up with the advance, he was always in the hottest part of the line, dressing wounded and organizing stretcher-bearers. Realizing that a R.A.P. could not cope with the casualties, he dressed them where they lay and made prisoners carry them back. In many cases he carried men back himself under heavy fire of all descriptions, and working in gas-drenched areas. He had no rest for three days and nights, and did another medical officer's, work as well as his own.

Lieut.-Col. James Hardie Neil, No. 3 Field Ambulance, New Zealand Army Medical Corps.

For conspicuous gallantry and devotion to duty during operations near Bapaume and Bancourt from August 23 to September 3, 1918. He was in command of the ambulance, and constantly visited the forward R.A.P. under heavy shell fire, and selected positions for the bearer relay posts. During the action round Bancourt he went forward with two light ambulance cars to within a few hundred yards of the front line and supervised the evacuation. It was owing to his gallantry and personal supervision that the evacuation of the wounded was so successfully carried out.

Awarded a Third Bar to the Military Cross.

Temp. Capt. Charles Gordon Timms, M.C., Royal Army Medical Corps, attached 7th Battalion, Royal Fusiliers.

For conspicuous gallantry and devotion to duty near Cambria on October 1, 1918, and during a severe enemy barrage, when his C.O. was wounded. He at once took up a squad of stretcher-bearers into the barrage to the rescue, tending his wounds and seeing that he was conveyed to a place of safety. (M.C. gazetted July 18, 1917; first Bar gazetted July 26, 1918; second Bar gazetted January 11, 1919.)

Awarded a Second Bar to the Military Cross.

Temp. Capt. (Acting Major) George Boyd McTavish, M.C., M.D., 99th Field Ambulance, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty west of Villers Guislain from September 19 to 27, 1918. He worked for eight days and nights, refusing to be relieved, walking constantly through heavy barrages and machine-gun fire, organizing bearer squads on the whole divisional front. Although gassed, he still carried on, and saved the life of an officer who was knocked over by a shell when he was talking to him, holding an artery till help came, he himself having been knocked over by the same shell. (M.C. gazetted October 29, 1916; Bar gazetted September 16, 1918.)

Awarded a Bar to Military Cross.

Temp. Capt. (Acting Major) John Crawford, M.C., 136th Field Ambulance, Royal Army Medical Corps.

In the area north of Ypres occupied by Belgian troops on September 28 to 30, 1918, he was conspicuous for his indefatigable efforts in evacuating the wounded from six field batteries and ten T.M. batteries. During the advance he was constantly well ahead, with complete disregard for his own safety; under heavy shell-fire and by his initiative and organization all the wounded were evacuated smoothly and rapidly. (M.C. gazetted March 3, 1917.)

Capt. William Donald, M.C., Royal Army Medical Corps (Special Reserve) (Salonika).

For conspicuous gallantry and devotion to duty during operations against Sugar Loaf and Thetassel on September 18 and 19, 1918. He went fearlessly forward under the heaviest fire to rescue wounded lying in front of the enemy's positions. By his courage he set the finest example to his stretcher-bearers, and was instrumental in saving many lives. He worked unceasingly for three days, and refused to rest until all wounded had been brought in. (M.C. gazetted January 1, 1918.)

Capt. Charles Marsh Gozney, M.C., M.B., 5th (London) Field Ambulance, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during the attacks on Happy Valley and Moislains between August 24 and September 2, 1918. He showed great initiative in moving his aid-posts forward and keeping in touch with the advanced troops. His arrangements for the evacuation of the wounded were splendid, and he undoubtedly was responsible for the saving of many lives. (M.C. gazetted August 16, 1917.)

Temp. Capt. Francis Henderson, M.C., No. 8 Field Ambulance, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty at Masnieres on October 1, 1918. He worked under heavy fire throughout the day and cleared the battlefield all through the night. Hearing that two officers of another division were lying out severely wounded, he made his way to them

under heavy shell fire, dressed them, and brought them safely in. His work throughout was magnificent. (M.C. gazetted July 26, 1918.)

Temp. Capt. Henry Leslie Messenger, M.C., Royal Army Medical Corps (Salonika.)

For conspicuous gallantry and devotion to duty on September 18, 1918, near Doldejeli. He led a party of stretcher-bearers some 400 yards across the open through a heavy barrage and succeeded in rescuing and bringing in a large number of casualties to his advanced post. The next day he established touch forward with the attacking battalions under heavy artillery and machine-gun fire. Throughout the action he showed the greatest energy and disregard of personal danger. (M.C. gazetted October 15, 1918.)

Capt. (Acting Major) William Barry Postlethwaite, M.C., M.B., Royal Army Medical Corps (Special Reserve), attached No. 54 Field Ambulance.

For conspicuous gallantry and devotion to duty on August 22, 1918, in clearing casualties at the crossing of the Ancre river. On August 25, 1918, he had great difficulties in the advance beyond Fricourt, owing to heavy shelling, but by a daring reconnaissance found a comparatively safe track for evacuating the wounded. On August 30, north of Combles, after searching all night, he again found a practicable evacuation route. His endurance and initiative were beyond praise. (M.C. gazetted October 28, 1917.)

Capt. (Acting Major) John Gray Ronaldson, M.C., M.B., Royal Army Medical Corps (Special Reserve), attached No. 14 Field Ambulance.

For conspicuous gallantry and devotion to duty in the operations near Cambrai from September 18 to 30, 1918. He was in charge of the bearers clearing the divisional front, and during the whole period he was living under heavy shell-fire including gas. Through casualties to medical officers, he had only one officer left to help him, but by constantly visiting the front posts he cleared all casualties and his cheerfulness kept up the spirits of the bearers. (M.C. gazetted January 18, 1918.)

Temp. Capt. (Acting Major) William Russell, M.C., M.B., 109th Field Ambulance, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty whilst in command of bearers near Bailleul on August 22 and 24 and September 3, 1918. He constantly visited all the R.A.P. by day and night, often under considerable shell and machine-gun fire, and disposed his bearers and ambulance cars with such skill that all wounded were collected and placed in the most favourable conditions for recovery with the utmost celerity. Later, he was gassed by a direct hit on his A.D.S. but continued to evacuate wounded until his relief arrived. (M.C. gazeted October 18, 1917.)

Capt. Hugh Kingsley Ward, M.C., M.B., Royal Army Medical Corps (Special Reserve), attached 2nd Battalion, King's Royal Rifle Corps.

For conspicuous gallantry and devotion to duty on July 10, 1918, when after an intense bombardment of several hours, the enemy attacked the battalion sector east of Newport Bains. During the bombardment he went up to the front line and remained in attendance on a badly wounded officer until he died. He was subsequently wounded whilst attending another officer, but continued looking after many other wounded men, until he returned to the dressing station, when he worked for over two hours in the open, and when the enemy approached he stood outside to prevent them bombing the wounded. (M.C. gazetted October 20, 1916.)

Canadian Force.

Capt. John Ernest Affleck, M.C., No. 9 Field Ambulance, Canadian Army Medical Corps.

For conspicuous gallantry and devotion to duty during the fighting east of Arras, August 26 to 28, 1918. His work was carried out under continuous shell and machine-gun fire, and many times he led his bearers close up to the front line, collecting seriously wounded men. By his cool judgment and energy he was enabled to get all the wounded under cover. (M.C. gazetted September 17, 1917.)

Capt. Duncan Arnold Morrison, M.C., No. 1 Field Ambulance, Canadian Army Medical Corps.

For conspicuous gallantry and devotion to duty during the operations on September 2 and 3, 1918, between Cagnicourt and Buissy, when he kept in touch with four infantry battalions, repeatedly going up and down under heavy fire, hastening the evacuation of the wounded. He was untiring in searching for any who might have been overlooked and directing the bearers in their duties. His coolness and judgment helped on the evacuation enormously. (M.C. gazetted January 11, 1919.)

Australian Imperial Force.

Capt. Kenneth Arthur McLean, Australian Army Medical Corps, attached 7th Brigade, Australian Field Artillery.

On August 31, 1918, near Clery, the battery was heavily shelled, two men being killed and two badly injured. He immediately went to the battery and commenced dressing one man who could not be moved. He continued his work until one shell burst close to him, wounding him severely in the arm and mortally wounding his stretcher-bearer who was assisting him. He showed marked courage and devotion to duty. (M.C. gazetted July 26, 1918.)

Capt. Cedric Murray Samson, M.C., 9th Field Ambulance, Australian Army Medical Corps.
On the morning of August 22, 1918, north of Chipilly, on the Bray-Corbie road, he took a car along to the R.A.P. in spite of heavy shelling and gas. He superintended the line of evacuation, continually taking fresh squads up to R.A.P. through heavy fire. Again, on August 31, he dressed a wounded medical officer and his orderly in the open, being wounded while doing so. During the period August 20 to 31, 1919, his fearless energy and devotion to duty were responsible for the rapid evacuation of many wounded. (M.C. gazetted June 3, 1918.)

AWARDED THE MILITARY CROSS.

Capt. Hugh Wabsey Bayly, Royal Army Medical Corps, Territorial Force, attached 293rd (London) Brigade, Royal Field Artillery.
On September 16, 1918, at Saudemont, when the village was heavily bombarded, in spite of the fact that he himself was ill, he remained at his post dressing and attending to the wounded, and throughout a trying period he displayed admirable composure and disregard of danger.

Temp. Capt. (Acting Major) James Biggam, M.B., Royal Army Medical Corps (D.A.D.M.S., 3rd Cavalry Division.)
For conspicuous gallantry and devotion to duty. On the night of October 3 to 4, 1918, he carried important messages to advanced collecting posts at Joncourt, the road being under heavy machine-gun fire and bombing from aircraft. On the night of October 9 to 10, he carried out an exhaustive reconnaissance of roads and villages under heavy shell fire. His untiring energy was worthy of great praise.

Lieut. George Edmondson Birkett, Royal Army Medical Corps (Special Reserve), attached 1st Battalion Gloucester Regiment.
For conspicuous gallantry and devotion to duty throughout September 15 and 16, 1918, during operations south of Maissemy. Working under heavy shell and machine-gun fire he brought in several wounded men. The enemy shot down many stretcher-bearers and stretcher parties on the 16th, but this officer worked indefatigably and continued to search for and bring in wounded until he was wounded in the spine by a sniper on the 16th. By his personal courage and energy he undoubtedly saved many valuable lives.

Temp. Capt. Daniel Michael Boohan, M.B., Royal Army Medical Corps. (Salonika.)
For conspicuous gallantry and devotion to duty during the attack on the "P" Ridge on September 18, 1918. Having established an aid-post and dressed a very large number of casualties, he moved forward with stretcher-bearers in front of the line and brought in wounded from the most exposed positions under trench-mortar and machine-gun fire. He worked continuously from dawn to dark, regardless of personal danger.

Capt. (Acting Major) Hector Mackay Calder, D.S.O., M.B., Royal Army Medical Corps, Territorial Force, D.A.D.M.S., 47th Division.
For conspicuous courage during operations between August 22 and September 8, 1918, in the region of Happy Valley, north of Bray and at Moislains. He did most valuable work evacuating wounded under most strenuous conditions, and during the many periods of heavy shelling his untiring zeal was a powerful stimulus to all ranks.

Temp. Capt. Graham Wilson Christie, Royal Army Medical Corps, attached 12th Battalion, East Surrey Regiment.
For conspicuous gallantry and devotion to duty during operations on October 1 and 2, 1918, near Gheluwe. He dressed the casualties of the advanced guard, under heavy shelling and machine-gun fire. During thirty-six hours he evacuated over 200 wounded from different units, working continuously without rest. His skill and quickness undoubtedly saved lives.

Temp. Capt. Ailwyn Herbert Clarke, Royal Army Medical Corps, attached 7th Division Guards.
For conspicuous gallantry and devotion to duty on October 10, 1918, about two miles north-west of Le Cateau. He several times proceeded under heavy shelling to the sunken road south-east of Rambourlieux Farm, to attend to wounded. He succeeded in dressing all the wounded under heavy fire, and got them carried away to safety.

Temp. Lieut. Christopher Dean, M.D., Royal Army Medical Corps, attached 1st Battalion, West Yorks Regiment.
For conspicuous gallantry and devotion to duty at Holnon during the operations of September 17 and 19, 1918. Although suffering from a sprained ankle, he was untiring in his efforts to collect and attend wounded. He was constantly exposed to shell fire but took no notice for himself, though he made his stretcher-bearers take cover.

Temp. Capt. Frederick Robert Dougan, M.B., 36th Field Ambulance, Royal Army Medical Corps.
On August 26, 1918, near Mametz, when this officer was clearing an infantry brigade, the Sussex Regiment was held up in a valley, the only exit from which was in full view of the enemy. Throughout the day this officer repeatedly brought up squads of bearers and superintended the removal of the wounded under continued heavy fire. Had it not been for his

personal courage the wounded of the battalion could not have been cleared for many hours. On another occasion he personally led a single squad under heavy fire in order to bring in a wounded N.C.O. of his own bearer division.

Temp. Capt. John Melville Elliot, M.B., Royal Army Medical Corps (Salonika).

For conspicuous gallantry and devotion to duty under heavy fire when in charge of stretcher-bearers on September 18 to 19, 1918. He took squads backwards and forwards from A.D.S. to R.A.P. near Sugar Loaf through heavy barrages. He also assisted in dressing wounded for forty-eight hours unceasingly in a constantly shelled camp. It was mainly due to his initiative and disregard of personal danger that touch was kept with R.M.O.s under very trying circumstances.

Temp. Capt. Alexander Keith Forbes, Royal Army Medical Corps, attached 1st Battalion Coldstream Guards.

For conspicuous gallantry and devotion to duty east of the Canal du Nord on September 27, 1918. Soon after zero, he established the R.A.P. on the Canal, having to cross a stretch of ground swept by machine-gun fire. From this well-chosen forward post, he was able to dress all the wounded of his own and other units, undoubtedly saving many lives. He went out many times into the shell-swept area and brought in wounded.

Temp.-Lieut. Benjamin Hutcheson, M.B., Royal Army Medical Corps, attached 2nd Battalion Highlanders.

During the operations east of Arras on August 30, 1918, he displayed conspicuous gallantry and devotion to duty, working in the open under heavy machine-gun and artillery fire attending to the wounded with an unselfish disregard of danger that was a splendid example to all.

Temp.-Capt. Henry Michael Joseph, M.B., Royal Army Medical Corps, attached 9th Battalion, Essex Regiment.

During operations August 8 to 10, 1918, near Morlancourt, this medical officer displayed great courage and energy in dealing with the wounded. On August 10, 1918, he moved forward immediately behind the fighting troops and saved many lives by timely action. When the objective was gained, and battle patrols went out, the enemy's machine-gun fire was especially heavy; he nevertheless went forward and dealt with cases, carrying one badly wounded man to a place of safety on his back under heavy fire.

Temp.-Capt. Charles Humphrey Lloyd, No. 8 Field Ambulance, Royal Army Medical Corps,

For great courage in guiding squads with wounded through Masnieres and the ground south-east of Rumilly on the night of October 1 to 2, 1918. He dressed a wounded officer in the open during a heavy burst of fire and got him away to safety. On October 3 he searched for wounded officers under fire, dressed their wounds, and brought them in.

Temp. Capt. James-Taylor Rogers MacGill, M.B., Royal Army Medical Corps (Salonica).

For gallantry and devotion to duty on September 19, 1918. He carried in wounded and dressed them, under intense machine-gun and artillery barrage. Later, on Sugar Loaf, for four hours he helped to carry in wounded after his stretcher-bearers were wounded. His courage and energy were the means of saving many lives.

Temp. Lieut. Rob Roy MacGregor, M.D., Royal Army Medical Corps, attached 2nd Battalion, Worcester Regiment.

For conspicuous gallantry and devotion to duty throughout the fighting of September 29, 1918, south of Villers Guislain. He worked untiringly under heavy shell fire, and though suffering from gas, attended over 200 cases. He had to carry out his work in the open, there being no available shelters.

Temp. Capt. George Barton McCaul, M.D., Royal Army Medical Corps (Salonika).

For conspicuous gallantry and devotion to duty. His battalion took up an advanced position of readiness in Jackson's Ravine early on September 19, 1918, and was for several hours exposed to concentrated shell fire. During this period he moved freely about attending to wounded, both of his own battalion and another unit, and showing total disregard for his personal safety. During the entire day his conduct was most exemplary and he undoubtedly saved many lives.

Capt. Edgar Llewellyn Foot Nash, M.B. (Special Reserve), Royal Army Medical Corps, attached 1st Battalion, Essex Regiment.

For conspicuous devotion to duty and contempt of danger in caring for wounded under heavy shell fire at Achiet-le-Grand on August 23, 1918. He moved about in the open under heavy shelling, dressing men's wounds and preparing them for immediate evacuation with the greatest coolness, setting a very fine example to his staff and to the bearers. It was due to his untiring efforts that the wounded were so successfully and quickly evacuated.

Temp. Capt. (Acting Major) Donovan Blaise Pascall, M.B., No. 11 Field Ambulance, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during the operations astride the Arras-Cambrai road on September 2, 1918. He was in charge of the evacuation of casualties from the front, and repeatedly made journeys over the shell-swept area around Dury and Eteritigny, locating and maintaining touch with R.A.P.s and bearer posts. Through his disregard of danger the casualties were speedily evacuated.

Temp. Capt. Harrold John Pickering, No. 15 Field Ambulance, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty from September 25 to 30, 1918, near Cambrai, especially one night, when hearing that there was a congestion of wounded at a R.A.P. he went forward through very heavy shell fire and remained all night, collecting bearers from every available source and supervising the clearing of the post. Throughout the whole period he only had one other officer to assist in the forward area. He inspired his men with his own cheerfulness, energy and endurance.

Capt. David Turnbull Richardson, M.B., Royal Army Medical Corps (Aden).
For conspicuous gallantry, initiative and resource on October 22, 1918, when in command of an advanced dressing station, in evacuating casualties under heavy rifle fire. He has shown similar qualities on several previous occasions.

Temp. Capt. (Acting-Major) George William Riddel, M.B., 129th Field Ambulance, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty during the attack on Gouzeaucourt, September 18, 1918. He went up to the most forward aid-post to organize the collection and evacuation of the wounded. Though dazed early in the action by the explosion of a shell near him, he carried on his duties untiringly through the day and night, often under heavy shell fire. His coolness and disregard of danger inspired confidence in the bearers and it was largely owing to him that the wounded were cleared so expeditiously.

Temp. Capt. Henry Albert Ronn, M.B., Royal Army Medical Corps, attached 3rd Dragoon Guards.
For conspicuous gallantry and devotion to duty in attending to wounded under heavy shell fire on October 3, 1918, near Montbrehain, and on October 9 at Hennechy. On both these occasions he set a fine example under most trying conditions.

Capt. John Rowland, Royal Army Medical Corps (Special Reserve). (Salonika).
For gallantry and devotion to duty during operations against the Tassei, on the night of September 17 to 18, 1918. He, although dangerously gassed, remained at duty and for three whole days worked incessantly rescuing our wounded, often in close proximity to the enemy's positions and under an intense fire. Despite much suffering from the effects of gas he persisted in his efforts, and by his fine example and personal exertions was the means of saving scores of lives.

Lieut. John Alexander Stewart, M.B., Royal Army Medical Corps, Special Reserve, attached 10th Field Ambulance.
During the operations astride the Arras-Cambrai road on September 2 and 3, 1918, he displayed conspicuous gallantry and unselfish devotion to duty, attending to the wounded under heavy fire with a disregard of danger that was a splendid example to all.

Temp. Capt. William Joseph Edward Stuttaford, No. 2 Field Ambulance, Royal Army Medical Corps.
Near Maissemy, September 23 and 24, 1918, he organized and superintended the evacuation of wounded under heavy shell fire. His courage inspired confidence among his men, and his initiative and resource saved many lives.

Temp. Capt. Arthur Macgregor Warwick, M.B., Royal Army Medical Corps, attached 1st Battalion, Royal Warwicks Regiment.
For conspicuous gallantry and devotion to duty. After an attack on St. Servin's Farm on August 30, 1918, when he had cleared his aid-post of all casualties, he organized stretcher-bearers and got in without delay a large number of wounded who were lying out in front exposed to heavy shelling. He carried out similar good work the following day.

Capt. (Acting-Major) Frank Wigglesworth, M.B., 23rd Field Ambulance, Royal Army Medical Corps, Territorial Force.
For conspicuous gallantry and devotion to duty on the night of September 11 to 12, 1918, prior to the attack on Havrincourt. Under heavy shell fire he reconnoitred the routes of evacaution and set out his bearer posts. The next morning during the attack he supervised the whole evacuation of the wounded, and for the next two days he kept well forward, advancing his cars and posts as circumstances allowed, thus evacuating the wounded with the least possible delay. His disregard of danger set a fine example all round.

Canadian Force.

Capt. (now Major) John Alfred Briggs, 10th Field Ambulance, Canadian Army Medical Corps.
During the fighting east of Arras, August 26 to 28, 1918, this officer worked continously. On many occasions he led his stretcher-bearers forward close up to the front line under heavy shell and machine-gun fire, to dress and evacuate wounded. Although blown up and bruised by a shell he refused to leave, and remained on duty. He set a fine example of gallantry and devotion to duty.

Capt. Frederick Thomas Campbell, Canadian Army Medical Corps, attached 8th Engineers, Manitoba Regiment.

For conspicuous gallantry and devotion to duty. During an advance on the Canal du Nord on September 3, 1918, the battalion suffered heavy casualties from shell fire, and as it was impracticable to evacuate the wounded, he went up and attended to them under heavy fire. Throughout four days he was conspicuous for his disregard of fatigue or danger and undoubtedly saved many lives by his efforts.

Capt. Lewis Piers Churchill, No. 8 Field Ambulance, Canadian Army Medical Corps.

During the fighting east of Arras, August 26 to 28, 1918, he was continuously on duty under heavy shell fire, and had absolutely no relief during the whole period. He kept in touch with all his R.A.P. and was responsible for the rapid evacuation of his wounded from the forward line. His zeal and devotion to duty were admirable.

Capt. Herbert Augustus Cochrane, Canadian Army Medical Corps, attached 13th Battalion Canadian Infantry, Quebec Regiment.

On September 2, 1918, when the battalion attacked the Drocourt-Queant line, although wounded two days previously he remained at duty, and established a dressing station well forward before zero hour. Shortly after the start of the attack he dressed several cases under heavy barrage and continued forward, dressing many wounded in the open under machine-gun fire. He worked all day, continually exposing himself, and his gallant conduct undoubtedly saved a great deal of suffering.

Capt. Frederick Brecken Day, Canadian Army Medical Corps, attached 54th Canadian Infantry.

On September 2, 1918, near Arras, for marked gallantry and devotion to duty. During the course of the battle he made many trips under heavy machine-gun fire to dress wounded and afterwards dressed wounded for hours in his aid post, not only those of his own battalion, but also of at least five other battalions and many wounded of the enemy. It was without doubt due to his exertions that the wounded were cleared so quickly and many lives were saved thereby.

Capt. Norman McLeod Halkett, Canadian Army Medical Corps, attached 38th Battalion Canadian Infantry, East Ontario Regiment.

For conspicuous gallantry and devotion to duty during operations against the Drocourt-Quéant line near Dury between September 1 and 3, 1918. Near Vis-en-Artois, the area in which the regimental aid-post was located was persistently searched by enemy artillery, causing many casualties. He attended to the wounded in the open in spite of heavy shelling. Later, the regimental aid-post was established in an open trench, and he again carried on under severe shell fire with untiring energy and utter disregard for his own personal safety.

Capt. Alexander Edward Macdonald, Canadian Army Medical Corps, attached 3rd Battalion, Canadian Infantry, 1st Central Ontario Regiment,

During the attack on Upton Wood August 30 to 31, 1918, he worked in the open under heavy fire, attending to and dressing the wounded, remaining at this duty until all the wounded were cleared, in spite of the heavy shelling. On one occasion a shell fell close to him, killing two men and severely shaking him, but he at once pulled himself together and went on with his work. His gallantry and composure were most marked.

Capt. Herbert Bruce MacEwen, Canadian Army Medical Corps, attached 5th Battalion Mounted Rifles, Quebec Regiment.

For conspicuous gallantry and devotion to duty near Monchy from August 26 to 28, 1918. He kept in close touch with the battalion in the advance, attending to the wounded in the open under heavy shell fire. He worked continuously, mostly in the open for thirty-six hours, and was largely responsible for the small percentage of killed in the unit.

Capt. Wesley McConnell Robb, Canadian Army Medical Corps, attached 2nd Canadian Mounted Rifles Battalion, 1st Central Ontario Regiment.

For conspicuous gallantry and devotion to duty on the Scarpe front from August 26 to 29, 1918. Shortly after zero his advance dressing station was blown in by shell fire. Though dazed and partly buried he immediately dug his orderly out. He then followed the battalion in the attack, organizing stretcher squads from prisoners and evacuating serious cases with the least possible delay. He several times attended serious cases in the firing line.

Capt. Joseph Gregor Shaw, 12th Field Ambulance, Canadian Army Medical Corps.

During the operations near Dury, September 2 to 6, 1918, he was in charge of stretcher-bearers. During the whole period he was constantly on duty. On several occasions he reconnoitred areas which were under heavy shell and machine-gun fire, dressing wounded and arranging for their evacuation in the open. In the vicinity of the windmill he came under heavy fire while attending to his duties. His work throughout was admirable, and his coolness in danger was an excellent example to his stretcher squads.

Capt. Harvey Gordon Young, D.S.O., Canadian Army Medical Corps, attached 49th Battalion, Canadian Infantry, Alberta Regiment.

For conspicuous gallantry and devotion to duty during the operations east of Arras from August 26 to 29, 1918. He was M.O. to the Battalion, and throughout the whole operation

followed up the attacking troops. Under heavy machine-gun and shell-fire he attended to wounded and organized stretcher squads of prisoners. He worked unceasingly, and it was entirely due to his personal energy and disregard of personal danger that all the wounded were evacuated before relief.

Australian Imperial Force.

Capt. John Claude Moseley Harper, 7th Field Ambulance, Australian Army Medical Corps, attached 28th Battalion, Australian Imperial Force.

During the operations on the Somme river and east of Mont St. Quentin on August 29 and September 2, 1918, he displayed the greatest gallantry and coolness in attending the wounded although he was under heavy shell and machine-gun fire the whole time. His untiring energy and splendid example and his personal supervision of the evacuation of the wounded yielded excellent results, in spite of most trying conditions.

Capt. Frederic Hobart James, Australian Army Medical Corps, attached 56th Battalion, Australian Infantry.

During the attack on Peronne on Septembert 1 to 3, 1918, this officer was conspicuous for his gallantry and devotion to duty, working unceasingly under heavy fire and practically without sleep during the whole period, attending to a large number of wounded. His energy and untiring self-sacrifice were worthy of the highest praise.

Capt. Christopher Norman Matheson, 7th Field Ambulance, Australian Army Medical Corps, attached 27th Battalion, Australian Imperial Force.

In the attack east of Mont St. Quentin on September 2, 1918, he pushed forward behind the first waves, attending the wounded under heavy artillery and machine-gun fire. Later he established a forward post, and through his gallantry and his untiring exertion he saved many lives by getting their wounds expeditiously dressed and evacuating them quickly.

Capt. Archibald Lang McLean, Australian Army Medical Corps, attached 17th Battalion Australian Infantry.

For conspicuous gallantry and devotion to duty. During the attack on August 8, 1918, east of Villers Bretonneux, near Amiens, he followed the attacking troops with his section, tending and dressing wounded under fire on the way. Almost immediately after the objective had been taken, he established his R.A.P. in the village of Warfusé, where he worked continuously under great difficulties. Later, during the advance on the following day, he established his R.A.P. almost on the jumping-off line, where he tended and cared for wounded under heavy artillery fire. His energy and zeal saved many lives.

Capt. Alexander Paterson Murphy, 1st Field Ambulance, Australian Army Medical Corps, attached 12th Battalion Australian Infantry.

For conspicuous gallantry and devotion to duty near Peronne from August 23 to 26, 1918, as R.M.O. of a battalion. He placed his aid post in a railway cutting, where he dressed the wounded of his own and other units under machine-gun and shell fire. When all our wounded had been cleared, he went out and attended to the enemy in the open ; while doing so a shell burst in their midst, killing his orderly, a stretcher-bearer and several wounded, and wounding him. He continued at work for another twenty-four hours before reporting for relief.

Capt. Reginald Edward Nowland, Australian Army Medical Corps, attached 157th Brigade, Royal Field Artillery.

For conspicuous gallantry and devotion to duty on September 27, 1918, near Ypres, with the leading battery, which came under heavy shell fire and suffered many casualties. Ignoring all danger, he established an aid post on the roadside and attended to the wounded. Later in the day, when the batteries moved farther forward, he visited all the gun positions and attended to the wounded.

Capt. (now Major) William James Ellery Phillips, 11th Field Ambulance, Australian Army Medical Corps.

For conspicuons gallantry and devotion to duty on September 6 and 7, 1918, during an advance on Rossel. He worked continuously for forty-eight hours in charge of the evacuation of the wounded from the forward aid posts. Although the area was heavily shelled he got his ambulance cars right up and cleared the wounded with great rapidity. His energy and perseverance set a splendid example to those working with him.

New Zealand Force.

Capt. John Davis Marks, New Zealand Medical Corps, attached 2nd Battalion, Canterbury Regiment.

For conspicuous gallantry during operations near Ruyaulcourt on September 4 to 5, 1918. While his rear aid post was twice heavily shelled and several casualties occurred he continued at duty, binding men up and shifting them to shelter in spite of the heavy bombardment. Again on September 7, when the rear aid post had been established on the edge of Havrincourt Wood, near Quotient Avenue, the enemy bombarded the place heavily. Under this fire, which had inflicted a number of casualties, he continued with his work. On both occasions his devotion to duty was admirable.

Capt. Eric Melvyn Wyllie, No. 1, Field Ambulance, New Zealand Medical Corps.

For conspicuous gallantry and devotion to duty south of Cambrai, from October 3 to 8, 1918. During five days' operation, constantly exposed to enemy fire, he reconnoitred the country for the establishment of bearer relay posts and car posts. On October 4, after establishing a car post at Masnieres, he went forward under heavy fire and established a bearer relay post on the bank of the canal, afterwards going forward and supervising the evacuation of wounded from rear aid posts.

CHANCERY OF THE ORDER OF SAINT MICHAEL AND SAINT GEORGE.

Downing Street,
February 7, 1919.

The King has been graciously pleased to give directions for the following appointments to the Most Distinguished Order of Saint Michael and Saint George, for services rendered in connexion with military operations in East Africa, dated January 1, 1919.

To be Additional Members of the Third Class, or Companions, of the said Most Distinguished Order :—

Temp. Lieut.-Col. Hugh Basil Greaves Newham, M.D., M.R.C.S., Royal Army Medical Corps,
Major (Acting Lieut.-Col.) Richard Edmond Humfrey, Royal Army Medical Corps.

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

St. James's Palace, S.W. 1.
February 7, 1919.

The King has been graciously pleased to give orders for the following appointments to the Most Excellent Order of the British Empire, for valuable services rendered in connexion with military operations in East Africa, dated January 1, 1919:—

To be Officers of the Military Division of the said Most Excellent Order :—

Temp. Capt. Charles Reginald Howard, Royal Army Medical Corps.
Temp. Capt. Quintus Madge, Royal Army Medical Corps.
Temp. Capt. Legh Richmond Herbert Peter Marshall, Royal Army Medical Corps.
Temp. Major Robert Semple, M.D., Royal Army Medical Corps.
Temp. Major Robert Standish-White, F.R.C.S.I., Royal Army Medical Corps, attached Northern Rhodesia Medical Corps.

War Office,
February 7, 1919.

His Majesty the King has been graciously pleased to approve of the undermentioned rewards for distinguished service in connexion with military operations in East Africa, dated January 1, 1919.

To be Brevet Majors :—

Capt. (Acting Lieut.-Col.) J. D. Kidd, M.C., M.B., Royal Army Medical Corps.
Capt. (Acting Lieut.-Col.) J. A. Manifold, D.S.O., M.B., Royal Army Medical Corps.
Capt. E. A. Sutton, M.C., Royal Army Medical Corps.

AWARDED THE MILITARY CROSS.

Capt. Atholl Robertson, M.B., Royal Army Medical Corps.

His Majesty the King has been graciously pleased to approve of the undermentioned rewards for distinguished services in connexion with military operations with the British Forces in East Africa :—

AWARDED THE DISTINGUISHED CONDUCT MEDAL.

Royal Army Medical Corps.

10912 Serjt.-Major J. H. MacMahon, 300th Field Ambulance (E. London).
36144 Staff-Serjt. (Acting Serjt-Major) F. Franks, 14th Casualty Clearing Station (Middlesbrough).
545844 Serjt. (Acting Staff-Serjt.) C. R. Hubert, 2nd London San. Company (London, W.).
33400 Serjt. (Acting Staff-Serjt.) P. Windebank, 19th Stationary Hospital (Brockley).
316307 Cpl. (Acting Serjt.) J. Hill, 1st Lowland Field Ambulance (Glasgow).
59868 Pte. W. Findlay (Edinburgh).
85874 Pte. T. G. Jones (Dingeston).
100803 Pte. (Acting Staff-Serjt.) S. Robinson, 15th Stationary Hospital (Thornton).
11439 Pte. G. A. Ross, 14th Casualty Clearing Station (Leighlin Bridge).
10718 Pte. (Acting Serjt.-Major) R. F. Stone, 15th Stationary Hospital (Dublin).

War Office,
February 11, 1919.

His Majesty the King has been graciously pleased to approve of the award of a Second Bar to the Military Medal to the undermentioned Man :—

1330 Pte. J. Wilson, M.M., 7th Field Ambulance, Royal Army Medical Corps (West Hoe). (M.M. gazetted August 17, 1917. First Bar gazetted October 7, 1918.)

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Military Medal to the undermentioned Non-commissioned Officer and Men :—

BAR TO THE MILITARY MEDAL.

45602 Pte. (Acting Cpl.) J. Hall, M.M., 38th Field Ambulance, Royal Army Medical Corps (Ampthill).
48036 Serjt. (Acting Staff-Serjt.) B. Thomas, M.M., 129th Field Ambulance, Royal Army Medical Corps (Mountain Ash).
88521 Pte. (Acting Lance-Cpl.) G. Chiffince, M.M., 142nd Field Ambulance, Royal Army Medical Corps (Battersea, S.W.).

His Majesty the King has been graciously pleased to approve of the award of the Military Medal for Bravery in the Field to the undermentioned Non-commissioned Officers and Men :—

ROYAL ARMY MEDICAL CORPS.

318003 Staff-Serjt. J. Mack, 2nd Field Ambulance (Clydebank).
538004 Staff-Serjt. B. A. Williams, 6th Field Ambulance (South Norwood).
18566 Serjt. (Acting Staff-Serjt.) H. Butler, D.C.M., 3rd Field Ambulance (Farnham).
46292 Serjt. (Acting Staff-Serjt.) B. Gooch, 100th Field Ambulance (Harwich).
48773 Serjt. W. J. Lewis, 129th Field Ambulance (Tumble).
459265 Serjt. J. H. Old, 2nd Field Ambulance (Camborne).
318010 Serjt. (Acting Staff-Serjt.) J. Spence, 2nd Field Ambulance (Glasgow).
475402 Cpl. A. R. Armes (Norwich).
9814 Cpl. F. W. Bishop (London, E.).
316066 Cpl. (Acting Serjt.) J. S. Campbell, 1st Field Ambulance (Glasgow).
27891 Cpl. J. Edwards (Nantymoel).
536120 Cpl. (Acting Serjt.) H. G. Fiveash, 5th Field Ambulance (Greenwich).
495301 Cpl. F. W. Fox (Dover).
4650 Cpl. J. P. Green, 4th Field Ambulance (Brackley).
27568 Cpl. W. Holmes, 89th Field Ambulance (Mansfield).
316229 Cpl. (Acting Serjt.) J. MacGregor, 1st Field Ambulance (Glasgow).
411173 Cpl. (Acting Serjt.) G. J. Micklewaite, 1st Field Ambulance (Royston).
346 Cpl. J. Middleton, 1st Field Ambulance (Kirkcudbright).
42836 Cpl. R. Murray, 26th Field Ambulance (Law).
24462 Cpl. A. Ridgway (Whitworth).
538003 Cpl. (Acting Serjt.) T. W. Slough, 6th Field Ambulance (Brimlay).
534014 Cpl. (Acting Serjt.) W. J. Smith, 4th Field Ambulance (Dartford).
48074 Cpl. W. Trigg, 130th Field Ambulance (Blaengarn).
492040 Cpl. H. Watson, 2nd Field Ambulance (Margate).
493499 Pte. A. S. Barling (Hurst Green).
61387 Pte. A. H. Barnes (Accrington).
90152 Pte. J. Barr, 9th Field Ambulance (Musselburgh).
45545 Pte. J. F. Barrett, 38th Field Ambulance (Margate).
3819 Pte. J. Barry, 100th Field Ambulance (Chelsea).
465128 Pte. E. Blight, 1st Field Ambulance (Plymouth).
54676 Pte F. Bothwell, 4th Field Ambulance (Dublin).
69293 Pte. J. A. Branigan, 9th Field Ambulance (Baily, Howth).
495158 Pte. E. J. Bright, 82nd Field Ambulance (Whitstable),
105129 Pte. C. E. Broadhead, 11th Field Ambulance (Armley).
38525 Pte. A. Browell (Sunderland).
47450 Pte. W. T. Chapman, 36th Field Ambulance (Saffron Walden).
403642 Pte. R. Cockerham, 2nd Field Ambulance (Woodlesford).
63579 Pte. J. T. Coole, 11th Field Ambulance (Liverpool).
6085 Pte. G. Cousins, 8th Field Ambulance (Taunton).
32732 Pte. O. J. Coxhead, 11th Field Ambulance (Liverpool).
31826 Pte. (Acting Lance-Cpl.) R. H. Crawford, 5th Field Ambulance (Liverpool).
318125 Pte. J. G. Currie, 2nd Field Ambulance (Giffnock).
88924 Pte. D. J. Davies, 4th Field Ambulance (Swansea).
388562 Pte. J. G. Davison, 87th Field Ambulance (Swalwell).
538188 Pte. A. P. Dudgeon, 6th Field Ambulance (Tunbridge Wells).
536105 Pte. F. C. Ellwood, 5th Field Ambulance (Penge).
90247 Pte. H. Fern, 13th Field Ambulance (Glasgow).
56221 Pte. W. H. Fisher, 1st Field Ambulance (Birmingham).
316357 Pte. W. Getwood, 2nd Field Ambulance (Glasgow).
64805 Pte. (Acting Lance-Cpl.) J. Gilroy, 100th Field Ambulance (South Shields).
497029 Pte. (Acting Lance-Cpl.) T. C. Goslin, 82nd Field Ambulance (Kingston-on-Thames).
48694 Pte. T. T. Griffiths, 10th Field Ambulance (Wrexham).
70620 Pte. (Acting Lance-Cpl.) J. Halkier, 4th Field Ambulance (Langley Park).
66426 Pte. (Acting Lance-Cpl.) L. S. Hammer, 100th Field Ambulance (Camborne).

48222 Pte. W. Harris, 130th Field Ambulance (Aberbeeg).
49220 Pte. E. J. Hayford, 28th Field Ambulance (Fulham).
57825 Pte. J. Hedges, 36th Field Ambulance (Hartley Wintney).
536407 Pte. S. K. Herbert, 5th Field Ambulance (Wood Green).
3480 Pte. (Acting Cpl.) G. H. Hutson, 1st Field Ambulance (Earlsfield).
31864 Pte. E. Hutton, 2nd Field Ambulance (Kelvinside).
48390 Pte. H. Jennings, 131st Field Ambulance (Cardiff).
90447 Pte. L. Jordan, 11th Field Ambulance (Sittingbourne).
10095 Pte. J. Larner, 2nd Field Ambulance (Chadsmore).
341462 Pte. P. Lea (St. Helens).
19803 Pte. (Acting Cpl.) A. Levy, 8th Field Ambulance (Goole).
48799 Pte. W. Lewis, 129th Field Ambulance (Pontygwaith).
459362 Pte. F. Lintern, 2nd Field Ambulance (Torquay).
421466 Pte. G. Lloyd (St. Albans).
120083 Pte. H. R. Mackey, 36th Field Ambulance (Uxbridge Road, W.).
538532 Pte. A. Mackie, 6th Field Ambulance (Melbourne).
1703 Pte. H. McConnell, 2nd Field Ambulance (Jarrow-on-Tyne).
1635 Pte. C. E. Marshall, 9th Field Ambulance (Leytonstone).
48158 Pte. F. T. Martin, 130th Field Ambulance (Mardy).
53382 Pte. E. W. Nash (Sandown).
4837 Pte. (Acting Lance-Cpl.) E. G. Newnham, 1st Field Ambulance (Hurlingham).
34564 Pte. (Acting Lance-Cpl.) A. Nimmo, 9th Field Ambulance (Falkirk).
53803 Pte. (Lance-Cpl.) W. Panton, 36th Field Ambulance (Stanley).
405434 Pte. G. A. Pashley, 7th Field Ambulance (Mexborough).
339518 (Lance-Cpl.) W. E. Pearse, 2nd Field Ambulance (Liverpool).
8814 Pte. E. G. Philbrick, 129th Field Ambulance (Colchester).
39584 Pte. T. Powell, 13th Field Ambulance (Blackwell).
48441 Pte. A. S. Powney, 131st Field Ambulance (Caerau).
66421 Pte. (Acting Cpl.) W. J. Price, 100th Field Ambulance (Dudley).
6636 Pte. W. E. Rees, 10th Field Ambulance (Llanelly).
48180 Pte. T. Richards, 130th Field Ambulance (Mountain Ash).
78233 Pte. R. A. Roberts, 3rd Field Ambulance (Liverpool).
8780 Pte. G. F. Robson, 1st Field Ambulance (North Shields).
49234 Pte. G. S. Scott, 38th Field Ambulance (Hixton).
41878 Pte. J. C. Scott, 13th Field Ambulance (Bolton).
43740 Pte. J. Sharples, 37th Field Ambulance (Farnworth).
405302 Pte. N. Shaw, 3rd Field Ambulance (Rotherham).
301197 Pte. A. G. Stewart, 89th Field Ambulance (Lossiemouth).
20469 Pte. (Acting Lance-Cpl.) J. T. Stewart, 10th Field Ambulance (Margate).
42982 Pte. R. J. Stocker, 142nd Field Ambulance (Romsey).
341372 Pte. A. Taylor (St. Helens).
65038 Pte. F. Tipping, 3rd Field Ambulance (Boxmoor).
48197 Pte. D. A. Thomas, 130th Field Ambulance (Penygroes).
20129 Pte. (Acting Serjt.) T. H. Thomson, 2nd Field Ambulance (Ebbw Vale).
102527 Pte. W. Valentine, 38th Field Ambulance (Tyldesley).
54309 Pte A. Walton, 141st Field Ambulance (Kentish Town).
46481 Pte. C. F. Warner, 36th Field Ambulance (Lower Kingswood).
508487 Pte. G. J. Willcocks, 2nd Field Ambulance (Ilford).
401489 Pte. A. Williamson, 1st Field Ambulance (Durham).
403330 Pte. C. V. Wright, 2nd Field Ambulance (Leeds).

AMENDMENTS.

The following are the correct descriptions of Men whose names have appeared in the *London Gazette* for the award of the Military and Meritorious Service Medals :—

Military Medal.

London Gazette, dated July 2, 1917 :—
8446 Pte. P. H. Patmore, 8th Field Ambulance, Royal Army Medical Corps. (Gazetted as P. M. Patmore.)
London Gazette, dated August 22, 1918 :—
10675 S. M. W. Richardson, Royal Army Medical Corps.
76650 Pte. H. Worsnip, 93rd Field Ambulance, Royal Army Medical Corps. (Gazetted as Worship.)

Meritorious Service Medal.

London Gazette, dated October 15, 1918 :—
4435 Pte. J. G. Hunter, No. 20, Command Cld. Station, Royal Army Medical Corps.

War Office,
February 15, 1919.

His Majesty the King has been graciously pleased to approve of the following awards to the undermentioned Officers in recognition of their gallantry and devotion to duty in the Field. The acts of gallantry for which the decorations have been awarded will be announced in the *London Gazette* as early as practicable.

AWARDED A BAR TO THE DISTINGUISHED SERVICE ORDER.

Capt. (Acting Lieut.-Col.) James Henry Fletcher, D.S.O., M.C., Royal Army Medical Corps, comdg. 36th Field Ambulance. (D.S.O. gazetted July 18, 1917.)

Major (Temp. Lieut.-Col.) Francis Cornelius Sampson, D.S.O., M.B., 91st Field Ambulance, Royal Army Medical Corps. (D.S.O. gazetted January 14, 1916.)

AWARDED THE DISTINGUISHED SERVICE ORDER.

Temp. Major Charles Fraser Knight, M.B., 133rd Field Ambulance, Royal Army Medical Corps.

Canadian Force.

Lieut.-Col. Stanley Paulin, 11th Field Ambulance, Canadian Army Medical Corps.

Australian Imperial Force.

Major Leonard May, M.C., Australian Army Medical Corps, attached 11th Bn. Australian Infantry.

New Zealand Force.

Capt. Patrick Augustine Ardagh, M.C., New Zealand Medical Corps, attd. 1st Bn., Auckland.

AWARDED A SECOND BAR TO THE MILITARY CROSS.

Temp. Capt. George Oliver Fairclough Alley, M.C., M.B., Royal Army Medical Corps, attached 2nd Bn. North Irish Regiment. (M.C., gazetted June 4, 1917. 1st Bar gazetted September 16, 1918.)

Lieut. (Temp. Capt.) William John Knight, M.C., M.D., Royal Army Medical Corps, attached 89th Field Ambulance. (M.C. gazetted May 31, 1916. 1st Bar gazetted February 18, 1918.)

Temp. Capt. (Acting Major) Maurice Aloysius Power, M.C., M.B., Royal Army Medical Corps, attached 148th Field Ambulance. (M.C. gazetted January 18, 1918. 1st Bar gazetted January 11, 1919.)

AWARDED A BAR TO THE MILITARY CROSS.

Capt. (Acting Major) John Bernard Cavenagh, M.C., Royal Army Medical Corps (Special Reserve), attached 113th Field Ambulance. (M.C. gazetted September 17th, 1917.)

Temp. Capt. Frederick Orlando Clarke, M.C., Royal Army Medical Corps, attached 149th Field Ambulance. (M.C. gazetted January 11, 1919.)

Temp. Capt. Claude Norman Coad, M.C., 74th Field Ambulance, Royal Army Medical Corps. (M.C. gazetted July 26, 1917.)

Capt. (Acting Major) Thomas Frederick Corkill, M.C., Royal Army Medical Corps (Special Reserve), attached 139th Field Ambulance. (M.C. gazetted September 26, 1917.)

Temp. Capt. (Acting Major) John Edgar Davies, M.C., 131st Field Ambulance, Royal Army Medical Corps. (M.C. gazetted September 16, 1918.)

Capt. (Acting Major) Frederick Gamm, M.C., Royal Army Medical Corps (Special Reserve), attached 2/3rd (Home Counties) Field Ambulance, Royal Army Medical Corps (Territorial Force). (M.C. gazetted July 26, 1918.)

Capt. (Acting Major) William Clavering Hartgill, M.C., 55th Field Ambulance. (M.C. gazetted January 1, 1917.)

Capt. (Temp. Major) Robert Alexander Hepple, M.C., M.B., Royal Army Medical Corps (Special Reserve), attached 28th Field Ambulance. (M.C. gazetted July 26, 1918.)

Temp. Capt. (Acting Major) Benjamin Knowles, M.C., M.B., Royal Army Medical Corps attached 88th Field Ambulance, Royal Army Medical Corps (Territorial Force). (M.C. gazetted March 26, 1918.)

Temp. Capt. Alexander Campbell White Knox, M.C., M.B., Royal Army Medical Corps, attached 2nd Bn. Royal Sussex Regt. (M.C. gazetted January 1, 1918.)

Temp. Capt. (Acting Major) Harold Dunmore Lane, M.C., Royal Army Medical Corps, attached 1/1st North Midland Field Ambulance, Royal Army Medical Corps (Territorial Force). (M.C. gazetted October 18, 1917.)

Temp. Capt. James David MacKinnon, M.C., M.B., Royal Army Medical Corps, attached 4th Bn. Liverpool Regt. (M.C. gazetted September 16, 1918.)

Capt. (Acting Major) William Archibald Miller, D.S.O., M.C., Royal Army Medical Corps (Special Reserve), attached No. 6 Field Ambulance. (M.C. gazetted November 14, 1916.)

Capt. (Acting Major) James Calvert Spence, M.C., M.B., Royal Army Medical Corps (Special Reserve), attached 34th Field Ambulance. (M.C. gazetted September 17, 1917.)

Canadian Force.

Capt. Franklin Fletcher Dunham, M.C., Canadian Army Medical Corps, attached No. 5 Field Ambulance. (M.C. gazetted October 18, 1917.)

Capt. Laurel Cole Palmer, M.C., 13th Field Ambulance, Canadian Army Medical Corps. (M.C. gazetted February 1, 1919.)

Capt. Joseph Gregor Shaw, M.C., 12th Field Ambulance, Canadian Army Medical Corps. (M.C. gazetted February 1, 1919.)

Capt. Donald George Kennedy Turnbull, M.C., 11th Field Ambulance, Canadian Army Medical Corps. (M.C. gazetted July 26, 1917.)

Australian Imperial Force.

Capt. John Shaw Mackay, M.C., 12th Field Ambulance, Australian Army Medical Corps. (M.C. gazetted January 18, 1918.)

AWARDED THE MILITARY CROSS.

Temp. Capt. (Acting Major) John Richard Percy Allin, 90th Field Ambulance, Royal Army Medical Corps.

Temp. Capt. (Acting Major) Basil William Armstrong, Royal Army Medical Corps, attached 100th Field Ambulance.

Capt. Edwin John Bradley, Royal Army Medical Corps (Special Reserve), attached 1/3rd N. Mid. Field Ambulance, Royal Army Medical Corps (Territorial Force).

Capt. Herbert Troughton Chatfield, Royal Army Medical Corps (Special Reserve), attached No. 6 Field Ambulance.

Temp. Capt. Thomas Clapperton, M.B., 141st Field Ambulance, Royal Army Medical Corps.

Capt. (Acting Major) Hubert Roy Dive, 1/2nd Mounted Brigade Field Ambulance, Royal Army Medical Corps, attached 230th Field Ambulance.

Temp. Capt. Robert Donald, M.D., Royal Army Medical Corps, attached 35th Field Ambulance.

Temp. Capt. Alexander John D'Souza, Indian Medical Service, attached 92nd Punjabis (Egypt).

Temp. Capt. William Balfour Gourlay, Royal Army Medical Corps (N. Russia).

Temp. Capt. Norman Frankish Graham, Royal Army Medical Corps, attached 6th Battalion London Regiment.

Temp. Capt. Richard Perrott Hadden, M.B., 103rd Field Ambulance, Royal Army Medical Corps, attached 152nd Brigade Royal Field Artillery.

Temp. Capt. Alexander Hunter, M.B., Royal Army Medical Corps, attached 63rd Divl. Eng.

Temp. Capt. William Boyd Jack, Royal Army Medical Corps, attached 5th Battalion Leicester Regiment (Territorial Force).

Temp. Capt. Matthew James Johnston, M.B., Royal Army Medical Corps.

Temp. Capt. Charles William Berry Littlejohn, 140th Field Ambulance, Royal Army Medical Corps.

Capt. Iorworth Hubert Lloyd-Williams, Royal Army Medical Corps (Territorial Force). attached 5th Battalion Lincolnshire Regiment (Territorial Force).

Temp. Capt. Alfred Mason, Royal Army Medical Corps, attached 229th Field Ambulance.

Lieut. William Percival Nelson, Royal Army Medical Corps (Special Reserve), attached 1/28th Battalion London Regiment.

Capt. John Archibald Nicholson, M.B., Royal Army Medical Corps (Special Reserve), attached 1st Battalion Seaforth Highlanders (Egypt).

Temp. Capt. Edward Rogerson, Royal Army Medical Corps, attached 2nd Battalion King's Royal Rifle Corps.

Temp. Capt. James Scott, Royal Army Medical Corps, attached 12th Battalion Manchester Regiment.

Temp. Capt. Thomas McCall Sellar, Royal Army Medical Corps, attached 1/18 London Regiment.

Capt. (Acting Major) Arthur Leonard Shearwood, Royal Army Medical Corps (Special Reserve), attached 33rd Field Ambulance.

Capt. Clifford Halliday Kerr Smith, M.B., Royal Army Medical Corps (Territorial Force), attached 1/4th Battalion, King's Own Scottish Borderers (Territorial Force).

Capt. John Stirling, Royal Army Medical Corps (Special Reserve), attached Head-Quarters 112th Brigade, Royal Field Artillery.

Temp. Capt. George Burkett Wilkinson, 28th Field Ambulance, Royal Army Medical Corps.

Canadian Force.

Capt. Alan Fenton Argue, Canadian Army Medical Corps, attached 87th Canadian Battalion Quebec Regiment.

Capt. Frederick Grant Banting, 15th Field Ambulance, Canadian Army Medical Corps.

Capt. James Harold Blair, Canadian Army Medical Corps, attached 72nd Battalion British Columbia Regiment.

Capt. Miles Gillespie Brown, Canadian Army Medical Corps, attached 85th Canadian Battalion Nova Scotia Regiment.

Capt. Lewis Hayes Fraser, Canadian Army Medical Corps, attached Royal Canadian Horse Artillery.

Capt. Gerald Wallace Grant, No. 4 Field Ambulance, Canadian Army Medical Corps.

Capt. Albert Robert Hagerman, Canadian Army Medical Corps, attached 78th Canadian Battalion Manitoba Regiment.

Capt. Charles Terrell Lewis, Canadian Army Medical Corps, attached 10th Brigade Canadian Field Artillery.

Capt. Harry Clarke Moses, Canadian Army Medical Corps, attached No. 5 Field Ambulance.

Capt. George Alexander Smith, Canadian Army Medical Corps, attached 47th Canadian Battalion West Ontario Regiment.

Capt. Joseph Townsend Stirling, 11th Field Ambulance, Canadian Army Medical Corps.

Capt. Richard Chapman Weldon, Canadian Army Medical Corps, attached 2nd Canadian Motor Machine-gun Brigade.

Australian Imperial Force.

Capt. Edwin Thomas Cato, Australian Army Medical Corps, attached 1st Battalion Australian Infantry.

Capt. James Mann Henderson, Australian Army Medical Corps, attached 12th Battalion Australian Infantry.

Capt. Kenneth Claud Purnell, Australian Army Medical Corps, attached 11th Brigade Australian Field Artillery.

Capt. Allan Melrose Purves, Australian Army Medical Corps, attached 2nd Tun. Company, Australian Engineers.

February 18, 1919.

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Distinguished Conduct Medal to the undermentioned Warrant Officer and Non-Commissioned Officer for gallantry and distinguished service in the field. The acts of gallantry for which the decorations have been awarded will be announced in the *London Gazettee* as early as practicable :—

339298 Staff-Serjt. W. Brookes, D.C.M., M.M., 63rd (West Lancaster) Field Ambulance, Royal Army Medical Corps (Territorial Force), (Liverpool).

Canadian Force.

530567 Serjt. J. H. Macfarlane, D.C.M., No. 9 Field Ambulance, Canadian Army Medical Corps.

His Majesty the King has been graciously pleased to approve of the award of the Distinguished Conduct Medal to the undermentioned Warrant Officers, Non-Commisioned Officers and Men for gallantry and distinguished service in the field. The acts of gallantry for which the Decorations have been awarded will be announced in the *London Gazette* as early as practicable:—

19882 Serjt. (Acting Staff-Serjt.) E. Arscott, 19th Field Ambulance, Royal Army Medical Corps, (Holloway).

4894 Serjt. (Acting Qmr.-Serjt.) W. J. Crossman, Royal Army Medical Corps (Tiverton). (Salonika.)

27568 Cpl. W. Holmes, M.M., Royal Army Medical Corps, attd. 89th (Highland) Field Ambulance, Royal Army Medical Corps (Territorial Force), (Mansfield).

47384 Serjt. W. McBrien, M.M., 34th Field Ambulance, Royal Army Medical Corps (Belleck, Co. Fermanagh).

128766 Pte. B. Norton, 91st Field Ambulance, Royal Army Medical Corps (Splott, Cardiff).

75074 Pte. W. N. Warren, Royal Army Medical Corps, attd. No. 2 Water Tank Company, Royal Army Service Corps (M.T.), (Barry).

Canadian Force.

532246 Cpl. (Acting Serjt.) D. P. Ewen, M.M., 12th Canadian Field Ambulance, Canadian Army Medical Corps.

524775 Serjt. M. Gunniss, M.M., 13th Canadian Field Ambulance, Canadian Army Medical Corps.

522714 Staff-Serjt. R. Souter, No. 7 Canadian Cav. Field Ambulance, Canadian Army Medical Corps.

Australian Force.

5511 Lance-Cpl. R. F. Cormack, M.M., 12th Field Ambulance, Australian Army Medical Corps.

12064 Pte. J. A. J. Sigers, 9th Field Ambulance, Australian Army Medical Corps.

AMENDMENTS.

The announcement of the award of the Distinguished Conduct Medal to the undermentioned Non-Commissioned Officer shown under "South African Force" should read as now stated :—

East Africa.

6019 Asst. Surg. A. B. Hamilton, East African Medical Service (*London Gazette*, dated October 3, 1918).

ISSUED WITH ARMY ORDERS DATED FEBRUARY 1, 1919.

FOREIGN DECORATIONS AND MEDALS.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for distinguished services rendered during the course of the Campaign.

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

DECORATIONS AND MEDALS CONFERRED BY THE PRESIDENT OF THE FRENCH REPUBLIC.

Croix de Guerre.

457006 Pte. (Acting Cpl.) William Finnimore, Royal Army Medical Corps, attd. 24th Field Ambulance (Exeter).

337280 Cpl. (Acting Serjt.) Bertram Douglas Lloyd, 2/1st West Lancaster Field Ambulance, Royal Army Medical Corps (Llandysilio, near Llanymyneck, S.O.).

2922 Pte. Duncan McCallum, Royal Army Medical Corps, attd. 2/1st Wessex Field Ambulance (Stirling).

473208 Lance-Cpl. (Acting Cpl.) Horace John Youngs, Royal Army Medical Corps, attd. 1/2nd Wessex Field Ambulance (Ipswich).

ARMY MEDICAL SERVICE.

Major David P. Johnstone to be seconded for service on the staff of the Governor of Bombay, dated November 25, 1918.

Major Arthur G. Cummins, M.C., is restored to the establishment, dated January 20, 1919.

Capt. Claude M. Rigby is restored to the establishment, dated November 25, 1918.

Lieut.-Col. and Brevet Col. Matthew H. G. Fell, C. M. G., is seconded for service with the R.A.F., dated November 26, 1918.

Capt and Brevet-Major John Gilmour, M.C., M.B., F.R.C.S.Edin., retires receiving a gratuity, dated February 23, 1919.

Lieut.-Col. William L. Steele, C.M.G., to be Acting Col. whilst employed as Assistant Director of Medical Services of a Division, dated December 29, 1918.

The undermentioned to be Acting Colonels whilst specially employed:—

Dated January 17, 1919.—Lieut.-Col. and Brevet-Col. Robert R. H. Moore, M.D.; Lieut.-Col. John C. Connor, C.M.G., M.B.

The undermentioned to be Acting Lieutenant-Colonels whilst in command of a Medical Unit:—

Dated May 18, 1918.—Major Osburne Ievers, D.S.O., M.B.
Dated August 11, 1918. Capt. John J. H. Beckton.
Dated September 12, 1918.—Capt. Guy O. Chambers.
Dated November 13, 1918.—Major Walter J. Weston, D.S.O.
Dated December 3, 1918.—Major Lionel V. Thurston, D.S.O.
Dated December 6, 1918.—Major Alastair N. Fraser, D.S.O., M.B.
Dated December 25, 1918.—Major Arthur C. H. Gray, M.B.
Dated December 28 1918.—Capt. Benjamin A. Odlum.
Dated January 4, 1919.—Capt. (Acting Major) George F. Allison.

The notification in the *Gazette* of January 20, 1919, regarding Major Walter J. Watson, D.S.O., is cancelled.

The undermentioned relinquish the acting rank of Lieutenant-Colonel on re-posting:—

Dated November 27, 1918.—Major Frederick J. Garland, D.S.O., M.B.
Dated December 14, 1918.—Major George G. Tabuteau. D.S.O.
Dated January 2, 1919.—Major John M. B. Rahilly, M.B.

The undermentioned Lieutenant-Colonels, from Royal Army Medical Corps, to be Colonels:—

Dated August 28, 1918.— (Temp. Col.) Norman Faichnie, M.B.; Claude B. Martin, M.B.
Dated September 13, 1918.—(Temp. Col.) Albert G. Thompson, C.M.G., D.S.O., M.B.
Dated October 10, 1918.—John B. Anderson.
Dated October 15, 1918.—Anthony H. Waring, D.S.O.
Dated October 23, 1918.—(Temp. Col.) Samuel A. Archer.
Dated October 24, 1918.—John McD. McCarthy, M.B.

The undermentioned Majors to be Lieutenant-Colonels:—

Dated May 2, 1918.—(Acting Lieut.-Col.) Richard F. Ellery.
Dated May 26, 1918.—Robert L. Popham.
Dated May 30, 1918.—(Acting Lieut.-Col.) Henry A. Bransbury, D.S.O.
Dated June 1, 1918.—(Temp. Lieut.-Col.) Alfred J. Hull, F.R.C.S.
Dated June 2, 1918.—(Acting Lieut.-Col.) Joseph F. Whelan, D.S.O., M.B.
Dated August 28, 1918.—John H. Brunskill, D.S.O., M.B.; (Acting Lieut.-Col.) Charles D. Myles, O.B.E., M B.
Dated September 13, 1918.—(Temp. Lieut.-Col.) Hugh A. Davidson, D.S.O., M.B.
Dated October 10, 1918.—(Acting Lieut.-Col.) Herbert R. Bateman, D.S.O.
Dated October 13, 1918.—William M. B. Sparkes, D.S.O.

Dated October 15, 1918.—(Acting Lieut.-Col.) Samuel B. Smith, D.S.O., M.D.
Dated October 23, 1918.—Roderick McK. Skinner.
Dated October 24, 1918.—(Acting Lieut.-Col.) Mervyn W. Falkner, F.R.C.S.I.
The undermentioned Captains to be Majors:—
Dated January 28, 1919.—(Acting Lieut.-Col.) Winfrid K. Beaman, D.S.O.; Colin Cassidy, M.C., M.B.; (Acting Major) Alexander D. Fraser, D.S.O., M.C., M.B.; Archer Irvine-Fortescue, M.B.; (Brevet Major) Howard G. Gibson; Frederick H. M. Chapman; Henry M. J. Perry; (Acting Major) John L. Wood; Frederick T. Turner, M.C.; (Acting Lieut.-Col.) Michael P. Leahy, M.B.; John E. M. Boyd, M.C.; (Acting Lieut.-Col.) Donald F. Mackenzie, D.S.O., M.B.; (Acting Major) Owen R. McEwen; (Acting Lieut.-Col.) William W. Boyce: (Acting Major) Malcolm O. Wilson, M.B.; (Acting Lieut.-Col.) John du P. Langrishe, D.S.O., M.B.; (Acting Lieut.-Col.) Thomas H. Scott, M.C., M.B.; (Acting Lieut.-Col.) Gerald F. Rudkin, D.S.O.; (Acting Major) Leopold A. A. Andrews; John H. Gurley; (Acting Lieut.-Col.) Alfred C. Elliott, M.B.; (Acting Lieut.-Col.) William B. Purdon, D.S.O., M.C., M.B.; (Acting Lieut.-Col.) Francis Casement, D.S.O., M.B.; (Acting Lieut.-Col.) Edward M. Middleton; Vincent T. Carruthers, M.B., F.R.C.S.Edin.; (Acting Major) Harold W. Farebrother.
The undermentioned Captains to be Acting Majors:—
Dated August 14, 1918.—James H. M. Frobisher, M.B.
Dated September 13, 1918.—Hugh G. Robertson, M.B.
Dated December 13, 1918.—William D. Anderton, M.C., M.B.
Dated December 23, 1918.—Alexander L. Aymer, M.B.
Dated December 25, 1918.—Alexander Hendry.
Dated January 3, 1919.—William W. MacNaught, M.C., M.B.
The undermentioned to be Acting Majors whilst specially employed:—
Dated December 19, 1918.—Capt. Arthur E. B. Jones, M.D.
Dated January 17, 1919.—Capt. James Vallance, M.B.: Capt. Herbert V. Stanley, M.C., M.B.
The undermentioned relinquish the acting rank of Major on re-posting:—
Dated July 6, 1918.—Temp. Capt. Eric E. Chipp.
Dated December 2, 1918.—Capt. Frederick R. Laing, M.B.
Dated December 12, 1918.—Capt. John P. Litt, M.D.
Dated December 27, 1918.—Capt. Sidney M. Hattersley, M.B.
Dated February 4, 1919.—Capt. William F. Christie, M.B.
Dated January 3, 1919.—Capt. Charles J. O'Reilly, M.C., M.D.
The notification in the *Gazette* November 25, 1918, regarding Capt. Charles J. O'Reilly, M.C., M.D., is cancelled.

ROYAL ARMY MEDICAL CORPS.

Major Robert G. Archibald, D.S.O., M.B., is placed on the half pay list under the provisions of Article 307 (7), Royal Warrant for Pay and Promotion, dated June 26, 1918.
Capt. Thomas Sheedy, Royal Army Medical Corps (Special Reserve) to be Staff Captain, dated January 16, 1919.
The undermentioned relinquish the acting rank of Lieutenant-Colonels on re-posting:—
Dated June 20, 1918.—Capt. Owen C. P. Cooke.
Dated October 16, 1918.—Major Edgar F. Q. L'Estrange.
The undermentioned to be Acting Lieutenant-Colonels whilst in command of a Medical Unit:—
Dated September 27, 1918.—Capt. (Acting Major) James J. D. Roche, M.B.
Dated October 30, 1918.—Major Ralph F. M. Fawcett, D.S.O.
Dated November 2 to 6, 1918 (inclusive).—Capt. Eric Catford.
Dated November 21, 1918.—Major Wilfred C. Nimmo.
Dated November 26, 1918.—Captain Oswald W. McSheehy, D.S.O., M.B.
The undermentioned Lieutenants (Temporary Captains) to be Captains:—
Dated January 1, 1919.—William J. Robertson, M.B.; (Acting Major) Joseph W. O'Brien, M.C., M.B.
Dated January 10, 1919.—Frederick R. S. Shaw, M.C., M.B.
Dated January 22, 1919.—(Acting Major) Cedric Russell, M.C., M.B.
Dated January 24, 1919.—Raymond Stowers, M.C.
Dated January 26, 1919.—William J. Knight, M.C., M.B.
Dated January 30, 1919.—(Acting Major) Reginald A. Mansell, M.B.
The undermentioned Majors to be Acting Lieutenant-Colonels whilst in command of a Medical Unit:—
Dated November 22, 1918.—Thomas H. Gibbon, M.D.
Dated November 24, 1918.—George R. Painton.
Dated December 6, 1918.—Thomas S. Blackwell.
The undermentioned Majors to be Acting Lieutenant-Colonels whilst employed as Assistant Directors of Medical Services of a Division:—
Dated September 17 to 22, 1918, inclusive.—John H. Brunskill, D.S.O., M.B.
Dated October 9, 1918.—William B. Sparkes, D.S.O.

The notification in the *Gazette* of December 4, 1918, regarding Captain Sydney J. Higgins is cancelled.

The undermentioned Captains relinquish the acting rank of Lieutenant-Colonels, and revert to the acting rank of Major, with pay and allowances of their substantive rank:—

Dated August 18, 1918.—James F. Grant, M.B.

Dated August 26, 1918.—Sydney J. Higgins.

The undermentioned Captains to be Acting Majors:—

Dated June 28 to August 9, 1918, inclusive.—Richard D. Davey, M.C., M.B.

Dated August 14, 1918.—Joseph P. Little; Edward P. A. Smith, M.C., M.B.; Francis A. Robinson, M.C., M.B.

The undermentioned to be Acting Majors:—

Dated May 29 to December 14, 1918, inclusive.—Capt. Benjamin A. Odlum.

Dated August 14, 1918.—Captain Edward A. Strachan, M.B.; Capt. Robert W. Vint, M.B.

Dated September 20, 1918.—Lieut. (Temp. Capt.) Frederick R. S. Shaw, M.C., M.B.

Dated October 16, 1918.—Capt. Donald H. C. McArthur, M.D.

Dated October 22, 1918.—Capt. Henry P. Hart, M.C., M.B.

Dated November 9, 1918.—Capt. William Foot, M.C., M.B.

Capt. (Acting Major) William Barnsley Allen, V.C., M.C., M.B., from Royal Army Medical Corps (Territorial Force), to be Captain, dated February 8, 1918, but not to reckon for pay or allowances prior to December 1, 1918, with precedence next below E. F. W. Grellier, and to retain his acting rank. (Substituted for the notification in the *Gazette* of December 19, 1918.)

OBITUARY.

MAJOR HOWARD GRAEME GIBSON, R.A.M.C.

Assistant Adviser in Pathology, G.H.Q., France.

We are indebted to Colonel S. L. Cummins, A.M.S., Adviser in Pathology, B.E.F., for the following tribute to this distinguished officer:—

As his commanding officer at the time of his death and as a close personal friend I feel constrained to record, even briefly, an appreciation of one whose ability and energy had already made valuable contributions to medical knowledge and who seemed certain to be destined to a brilliant career in the Corps. He was born in 1883 and received his medical education at Guy's Hospital. He entered the Royal Army Medical Corps on January 28, 1907, being promoted captain on July 20, 1910, and brevet-major, January 1, 1918.

My first personal contact with him was when, early in the spring of 1914, he formed one of the specialist class in bacteriology at the promotion course at the Royal Army Medical College. Gibson entered into the work of the laboratory with enthusiasm. It was a pleasure to have in the class a man with such keenness and avidity for work. From the very beginning he stood out as the possessor of exceptional ability, and the favourable opinion which I had formed of him was justified when, at the end of the course, he made the highest marks in the specialist examination, and, by his success in other subjects as well as bacteriology, succeeded in qualifying for a year's acceleration of promotion.

A few months later the outbreak of war swept Gibson, like so many others, away from scientific work to take an active part in the great world drama. He joined the 12th Royal Lancers, and with them proceeded at once to the Front. The duties of a regimental medical officer with cavalry during the first phases of the war put the highest strain on initiative, endurance, and courage. This test Gibson met with his usual cheery energy and zeal. Throughout the retreat, throughout the advance, during the battles of the Marne and of the Aisne, and later, when the British Expeditionary Force was rapidly and secretly moved north to defend the Channel Ports, he shared with the regiment its trials, hardships, dangers, and glories. Then, just when open warfare was changing to the war of trenches, and when the cavalry was helping, dismounted, to eke out our numerically weak infantry, Gibson was severely injured by a shell burst, and was sent home to England, where many months of hospital treatment were necessary before he could resume military duty.

This injury and disability, so galling at the time to one whose whole soul was with the Army, proved a blessing in disguise, for it led to his resumption of the bacteriological work for which he was so well qualified. Being quite unfit to resume active duty at the Front, Gibson was now posted to the Vaccine Department of the Royal Army Medical College. Here, working under Lieut.-Col. D. Harvey, he had full scope for the application of his special knowledge. Although the claims of the Vaccine Department made necessary long hours of routine work, still, encouraged and aided by Harvey, he found time to devote himself to research on protection against bacillary dysentery. The result was a brillant piece of work communicated to the Journal of the Royal Army Medical Corps (June, 1917); it culminated in the production of Gibson's antidysenteric sero-vaccine. The severe reactions following the inoculation of unaltered dysentery bacilli had for the most part prevented the use of antidysenteric vaccines. Gibson, recognizing the danger

that the sensitization of bacilli by the homologous antiserum might, while eliminating the severe reaction, eliminate also the value of the emulsion as antigen, conceived the ingenious idea of removing from the serum, by absorption, all its anti-bacterial "immune bodies" while retaining the anti-endotoxic substances. Such a serum injected simultaneously with the appropriate dose of killed dysentery bacilli might be expected to prevent any severe local reaction while still leaving the bacteria uninjured and capable of evoking in the body the production of agglutinins, opsonins, and other anti-bacterial immune substances. Experiments on animals proved this conception to be correct, and the new principle was soon applied in practice, large supplies of the sero-vaccine being manufactured and sent abroad. While it is still too early to put forward final claims for the value of this sero-vaccine, all the reports received have so far been favourable, and there is every reason to hope that many lives will be saved by this means in the future.

In November, 1917, Gibson, now greatly improved in health, was passed "fit" for service in France, and joined Sir William Leishman as assistant adviser in pathology at headquarters. Here he threw himself with his usual ardour into statistical work connected with the effects of T.A.B. inoculation and the use of antitetanic serum. His neat and thorough records are before me as I write, and will constitute a valuable source of reference in the future. When, in April, 1918, I succeeded Sir William Leishman as adviser in pathology, my task was rendered easy by the fact that Gibson, who remained on as my assistant, had at his fingers' ends every fact connected with the office records and every detail of the work in hand. Then came the autumn epidemic of influenza, with its high death-rate and its many unsolved problems. Research was a matter of supreme necessity, and the number of men qualified to execute such work, and at the same time actually available for employment, was very small. I had decided that a research team was needed at once. It seemed waste to keep such a man as Gibson occupied with office records when knowledge, enthusiasm, and technical skill were so badly wanted. He welcomed my suggestion with the greatest delight, and I was able to include him as the senior officer of the team. His colleagues were Major F. B. Bowman, C.A.M.C., and Captain J. J. Connor, A.A.M.C., with whom was associated for clinical work, Major C. E. Sundell, R.A.M.C. Helped generously by the provision of experimental animals through the Medical Research Committee, these officers were successful in transmitting the disease to monkeys and other animals by the inoculation of filtrates of infected material,[1] thus confirming the work of C. Nicolle and Lebailly. They went further and, employing the "Noguchi" method, were successful in obtaining cultures of a very minute filter-passing coccus which reproduces, on inoculation into animals, the symptoms of the disease. This work has been completely confirmed by the publication by Sir J. Rose Bradford of similar observation made by Captain J. A. Wilson, R.A.M.C., who, unknown to Gibson, had been successful in making Noguchi cultures of what appears to have been the same organism some months before this was done by Gibson, Bowman and Connor. At the very moment of success, when the work of months had at last reached its final stage, Major Gibson, who had been putting in long hours with his cultures in the laboratory, himself developed the disease in its severest form. Those who best knew him will appreciate what the Army and the Corps have lost through his untimely death. He was a man who seemed destined to a career of distinguished success and utility. Lives such as his add fresh laurels to the splendid traditions of the Royal Army Medical Corps.

Major-General Sir William Leishman, K.C.M.G., C.B., F.R.S., K.H.P., writes: To the above appreciation of the late Major H. G. Gibson by Colonel Cummins, to every word of which I subscribe, I should like to add a few lines.

Sudden death and the cutting short of what promised to be a brilliant career has, alas! been all too frequent during recent years, but the poignancy of sorrow and regret for relatives and friends remains as sharp as ever at each fresh loss. Of the many friends and comrades whose lives have been given for their country during the war there are none whom I shall miss more acutely than Major Gibson. It was indeed an irony of fate that he should have met his death at the very moment when his devoted investigations into the etiology of the disease which killed him appeared likely to be crowned with a success which would have brought him well-deserved distinction.

No man had ever a better or more loyal colleague to work with, and in the months in which we were associated in France I not only formed the highest opinion of his work and judgment, but also of his upright and sterling character. No one could have lived long in close association with him without realizing the rare qualities of his nature and conceiving for him a deep and genuine affection. In illustration of this, I may, perhaps, quote a sentence from a letter received from one of the colleagues associated with him in his last work. "He was one of the finest characters I have ever met, and never in the six months that I knew him did I hear him say anything against any one."

One would like to think that it may, perhaps, be some small consolation to his widow and family to know that his brother officers will not readily forget their lost friend, and that a large number of them realize very clearly the great loss which the Corps has suffered in the early passing of a man whose work had already stamped him as destined to rise high in the line to which he had devoted himself so whole-heartedly.

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[1] *British Medical Journal*, December 14, 1918, p. 645.

AUXILIARY ROYAL ARMY MEDICAL CORPS FUNDS.

The usual Quarterly Meeting of the Committee was held at 2.30 p.m. on January 31, 1919, at 11, Chandos Street, W. 1., Colonel Ewen Maclean (Chairman), in the Chair. Grants were made to the widows and orphans of four officers, and to the widows and orphans of seven men of the rank and file. Widows or orphans of officers or men of the Auxiliary Royal Army Medical Corps requiring help should apply to the Hon. Secretary of the Funds at 11, Chandos Street, Cavendish Square, W. 1.

THE BENEVOLENT AND RELIEF FUNDS OF THE CORPS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—As Secretary of the Army Medical Officers' Widows and Orphans Fund, I have received lately several liberal gifts evidently sent under the impression that this Fund is a charitable one. I should be grateful if you could allow me space to explain that it is a Life Assurance Society providing annuities for the widows and orphans of Regular Officers of the Corps.

In case you may consider the present an appropriate time in which to draw attention to the various Benevolent and Relief Funds of the Corps, I venture to attach a short description of them below.

I am, Sir,
Your obedient servant
T. J. CLAPHAM, *Captain*,
Secretary.

3, *Homefield Road*,
Wimbledon, S. W.
February 11, 1919.

ROYAL ARMY MEDICAL CORPS OFFICERS' BENEVOLENT SOCIETY.

The object of this Society is to afford relief to the orphans of Regular Officers of the Corps who may be left in distress, and to help to procure for them a better education than their limited means would otherwise permit.

GENERAL RELIEF BRANCH OF THE ROYAL ARMY MEDICAL CORPS FUND.

This Fund gives help in cases of distress occurring among warrant and non-commissioned officers and men of the Royal Army Medical Corps, past and present, and their wives, widows and children.

The Secretary of these two Funds, which it will be noted deal solely with Regulars, is Lieut.-Col. E. M. Wilson, C.B., C.M.G., D.S.O., 124, Victoria Street, S.W.1.

The following Funds are for the benefit of officers, warrant officers, non-commissioned officers and men of the New Army, the Territorial Force and the Special Reserve.

AUXILIARY ROYAL ARMY MEDICAL CORPS FUNDS.

(a) *Officers' Benevolent Branch.*

This Fund helps in educating children of officers of the Auxiliary Royal Army Medical Corps who have lost their lives during the present war, or have been severely disabled by it.

(b) *Relief Branch.*

Helps the widows and children of warrant and non-commissioned officers and men of the New Army, Territorial Force, and Special Reserve.

The Honorary Secretary of these Auxiliary Royal Army Medical Corps Funds is Col. Sir W. Hale White, K.B.E., 11, Chandos Street, Cavendish Square, W. 1, to whom requests for help, as well as subscriptions, should be addressed.

ARMY MEDICAL OFFICERS' WIDOWS AND ORPHANS FUND.

NOTICE.

At a meeting of the Committee of this Society held on January 16, 1919, it was resolved unanimously, on the advice of the Consulting Actuary, that the present extra war premium for new entrants into the Society be suspended until further notice.

This fund provides annuities of £50 a year during widowhood, to the widows of officers who have held permanent commissions in the Royal Army Medical Corps. In the event of the death of a widow this annuity is continued to the children of such marriage until the youngest attains the age of 21 years. It also continues for their benefit, up to the same age, if the widow re-marries. Furthermore, should the wife of the subscriber predecease him, it will be optional for him to continue the subscription he had been paying as a married member, in order to provide an annuity similar to the above for the children of the marriage, until the youngest shall have attained the age of 21 years.

Provision is also made whereby a part of the surplus at any quinquennial valuation may be applied for the benefit of members, or their widows, or orphan children. Thus, by the appropriations of surplus at the valuations of December 31, 1910 and 1915, the prospective widows of first-class married members on the books at those dates will receive, during this current quinquennium, £200 and £100 respectively at the death of their husbands, their annuities being also increased to the statutory limit of £52.

Unmarried members pay an annual subscription of £2, and on passing to the married class are allowed the equivalent of all past subscriptions in the unmarried class by way of reduction of their annual subscription in the married class.

Examples of the annual subscription for married members are :—

Husband's age	Wife's age	Annual subscription
25	20	£13 8 5
30	27	£14 6 1
36	33	£16 17 2
46	40	£22 12 6
50	45	£24 9 5

The Secretary will be glad to give any further information as to details.

3, *Homefield Road,*
Wimbledon, S.W. 19.
January, 1919.

J. T. Clapham, *Captain,*
Secretary.

ROYAL ARMY MEDICAL CORPS CENTRAL MESS FUND.

Summary of the Proceedings of a Meeting of the Committee held at the Royal Army Medical College on February 25, 1919.

Present.

Lieut.-Col. D. Harvey, C.M.G., in the Chair.
Major C. J. Coppinger representing Aldershot.
Captain H. S. Dickson representing Woolwich.
Captain L. C. Hayes representing London.
Lieut. J. Reynolds representing Portsmouth.

(1) The Minutes of the previous meeting were read and confirmed.

(2) A resolution of regret and sympathy was recorded at the deaths of Majors W. A. Ward and H. Graeme Gibson who had represented Aldershot and London at the meetings of the Committee during the past two or three years.

(3) Applications from various Messes were considered. The Mess at Colaba having asked for a grant or loan towards the Rs. 1,245 necessary to purchase Government Mess furniture, which would otherwise have to be returned, the Hon. Secretary was directed to reply that, unless under exceptional circumstances, the Committee did not consider that temporary War Messes came within the scope of the Fund, and to ask whether there were any probability of the Colaba Mess becoming a permanent one.

Addington Park Mess, having asked for a grant in aid of equipment, was requested to give an estimate of the sum needed; to say whether anything definite were known as to how long the Mess there was likely to be kept open; and to state how many of the Regular Officers belonging to it were subscribers to the Central Fund.

The London Mess applied for a grant to meet Fire, Burglary and Aircraft Insurance premiums for the year ending March 31, 1919, amounting to £38; and also the annual charge of £41 4s. 6d.

for the pension scheme for Brewer and Elliott. As this Mess is still closed, and there is no income to defray these necessary expenses, a grant of £79 4s. 6d. was sanctioned for that purpose.

A grant of £10 was made to the Mess at Tidworth to meet a debt for barrack damages and breakages, the Committee considering that the circumstances were exceptional.

A request was made for help towards providing a billiard table in the somewhat isolated Mess at Cosham. Some members of the Committee thought that there might be less difficulty in procuring a table than in providing the necessary room for it. It was pointed out that Cosham was one of the few permanent Messes which had hitherto made no claim on the Fund. The request was considered a reasonable one if present prices were not prohibitive. Cosham was asked to make inquiry as to whether table or building, or both, can be supplied by the Government; and if not to submit estimates of cost to the next meeting.

(4) The Hon. Secretary reported that, as authorized at the previous meeting, £200 six per cent Exchequer Bonds, 1920, had, on the advice of Messrs. Holt, been sold, realizing with interest £207 3s. 5d.; and £200 five per cent National War Bonds, 1928, had been purchased in their place. Cash surplus to the amount of £500 had in the course of the year been invested in this latter security, of which the total held now amounted to £700. The Central Fund had in addition £1,150 invested in five per cent War Loan, 1929-1947.

(5) Some 190 officers having joined the Corps since the beginning of the War, the Hon. Secretary stated that he had again sent out notices as to the objects of the Fund to each of them; though no doubt, as on previous occasions, many of these would fail to reach; so far forty had become subscribers.

(6) It was unanimously resolved that Mr. E. T. Gann, who has audited the accounts of the Fund since its formation, be asked to do so for the year ending February 28, 1919.

(7) Refund to the Hon. Secretary of £2 15s. 9d., expended by him on postage, typing, stationery, etc., since November, 1917, was sanctioned; as was payment of printer's account of £2.

3, *Homefield Road*,
Wimbledon.

J. T. Clapham, *Captain*,
Hon. Secretary.

ROYAL ARMY MEDICAL CORPS PRISONERS OF WAR FUND.

REPORT FOR THE YEAR 1918-1919.

In the latter part of 1917, before the battle of Cambrai, there were only thirty-two Royal Army Medical Corps prisoners of war left in Germany. It was known, however, that nearly two hundred non-commissioned officers and men of the Corps had been taken prisoners at that time, and that parcels would have to be sent to them as soon as their whereabouts could be ascertained.

The additional burden thus thrown upon the Fund necessitated an appeal for support, and early in 1918 Mrs. Morgan, who had started the Comforts Fund at the beginning of the War, sent a circular letter to the officers of the Corps appealing to them to subscribe funds for this purpose.

Shortly afterwards Col. Wilson sent out a similar appeal to Officers commanding Royal Army Medical Corps Companies and Units at home and abroad, and Territorial General Hospitals, asking for assistance from canteen committees and recreation rooms of the Corps for our Prisoners of War Fund.

As will be seen, these appeals met with a very handsome response.

In February, 1918, Mrs. Morgan having resigned the Hon. Secretaryship in order to join Col. Morgan in Washington, Mrs. Tilbury Brown was appointed to take her place. Mrs. Brown acted as Hon. Secretary until May 13, when Mrs. F. R. Buswell took over the position.

In the spring of the same year the Committee experienced difficulty in procuring stores, and it was therefore decided to purchase all our supplies from the Central Prisoners of War Committee. The Central Committee thereupon nominated the Fund as a sub-depot and gave us sanction to store bonded and rationed goods. This arrangement worked very satisfactorily, although, as can be imagined, it involved a very great addition to the responsibilities and duties of the Hon. Secretary.

Owing to the increase of work incurred by packing and dispatching food and clothing to the men, the Committee had been forced some time previously to cease the dispatch of "Comforts" to troops in the Field. Many subscribers, too, asked when sending donations that their money should be applied exclusively for the benefit of the prisoners of war. It would have been impossible to divide the work of the Fund into two separate and distinct portions, so it was decided at a Committee meeting on May 13 to change the designation of the Fund to "The Royal Army Medical Corps Prisoners of War Care Committee."

The course of events proved this to have been a wise and necessary step. The number of Royal Army Medical Corps prisoners in the hands of the Germans had been steadily increasing during the spring offensive of 1918, and a great rise in their numbers took place after May 27. This increase of course led to more and more work as time went on, and it was ultimately found

necessary to ask for extra rooms in which to carry it on. The Commandant of the Royal Army Medical College, Major-General Sir David Bruce, was approached, and he at once set aside the whole of the Mess for our use. This gave us all the room we required and enabled us to re-arrange our departments so that each branch of the work could have a room to itself. The ante-room was used for accommodating the secretarial staff; the mess-room for the packing, stringing and labelling of the parcels of grocery; while the packing, etc., of the clothing was carried out in the smoking-room.

It may convey some idea of the work to know that we sent off nine tons of food every fortnight, all of which had to be packed up into the regulation sized parcels.

In July, 1918, the Central Committee informed us that owing to the enormous increase in the work they could no longer supply transport for stores.

It was suggested that the Royal Army Service Corps might help in this difficulty, and the situation was laid before the Director-General Army Medical Services, with the result that three lorries were allotted for our use on alternate Tuesdays to bring the stores from the Central Committee Depot at Thurloe Place to the Mess.

REPORT OF THE PROCEEDINGS AT THE FINAL MEETING OF THE COMMITTEE IN THE ANTE-ROOM OF THE ROYAL ARMY MEDICAL CORPS MESS ON MARCH 11, 1919.

Present.

Lady Goodwin, President.	Mrs. Tilbury Brown.
Lady Bruce.	Mrs. Bull.
Lady Riddell.	Mrs. Glanvill.
Mrs. Morgan.	Mrs. Buswell, Hon. Secretary.

The minutes of the Committee Meeting held on December 6, 1918, having been read, the Hon. Secretary explained that on the closing down of the Committee's work there remained on hand a considerable quantity of stores. The duty on these goods amounted to a little over £300. This amount was paid to the Excise Authorities and an arrangement was come to with the Food Controller as to the disposal of the goods. In accordance with this arrangement a certain proportion was sold to the ladies who had voluntarily assisted the Fund, and the remainder—by far the largest part—to the Sisters and Officers, and the non-commissioned officers and men of No. 35 Company Royal Army Medical Corps, Millbank, by the kind assistance of Serjt.-Major Sproule.

(2) The work of the Committee since the signing of the Armistice has been chiefly secretarial and can be roughly grouped under the following heads:—

(*a*) The lists of repatriated men came in very slowly from Dover and Hull, the two ports where the men were landed on their arrival from Germany. There was a great deal of repetition in the lists, which gave rise to considerable additional labour in checking them.

(*b*) The delay in repatriation caused a good deal of correspondence with relatives of prisoners, who were naturally anxious to know what was happening to their friends.

(*c*) Preparing a statement, called for by the Central Committee, of the number of non-acknowledged parcels sent to the Prisoners of War Camps at Parchim, Stendal, Gustrow, Friedrichsfeld and Limburg.

These were the registered addresses allowed to be sent home by a large number of prisoners who were actually being starved while working behind the German lines, or in mines, or in Kommandos, sometimes more than 100 miles distant from the registered camp, and whose parcels were not sent on to them.

A claim for these is being lodged against the German Government. Our statement was as follows:—

Camp	Number of men	Number of parcels	Number of parcels acknowledged
Parchim ..	139	2,655	690
Stendal ..	77	1,498	130
Gustrow ..	41	832	233
Friedrichsfeld	69	690	31
Limburg	77	1,801	282
	403	7,476	1,366

There were 125 prisoners of war of whose whereabouts we could get no information whatever.

(*d*) Correspondence with other care committees and local associations regarding Royal Army Medical Corps men who, having worked in German hospitals, were considered as likely to be able to give information about men of other regiments who had died in Germany.

(*e*) Many letters also came to hand from mayors of provincial towns asking for the names of local Royal Army Medical Corps men who had been prisoners of war, so that on their return to England they could be suitably entertained by their townspeople.

(*f*) The Central Committee experienced some difficulty in obtaining their statements of accounts. This, of course, has the effect of delaying our accounts with them.

(*g*) Our Christmas parcels were dispatched on November 8. When the armistice was signed, however, the authorities decided that the parcels from the different care committees should be

pooled for the general benefit of all British prisoners of war indiscriminately. This, of course, meant that our parcels did not reach the people for whom they were intended, much to their disappointment. We heard from Royal Army Medical Corps men who had met men of other regiments who had received these parcels, and several wrote asking if we had any spare copies of the Christmas cards left, as they would like to have them.

(3) The above applies to Royal Army Medical Corps men in the hands of the Germans. There were a few prisoners also in Turkey and of course parcels were sent to them as well. But the regulations regarding these were constantly changing, and comparatively few of the parcels ever reached their destinations. We also used to send each man a monthly money allowance of £1. Occasionally the men received it, more often they did not. There were altogether nineteen Royal Army Medical Corps men in Turkish hands and of these eight died.

Subscribers to the Fund and helpers will be glad to know that the Prisoners of War are most grateful for their efforts. Many of the repatriated prisoners have called upon us to tender their thanks personally, and they all asked us to thank the subscribers to the Fund on their behalf. We have also received a good number of letters in the same strain from other repatriated prisoners whose way home did not lie through London and who were therefore unable to call in person.

(4) The signing of the Armistice, as has already been explained, put an end to the sending of parcels addressed to individuals, but we were asked if we would pack until further notice, one thousand unaddressed parcels weekly to Rotterdam and Copenhagen, to be used for feeding Prisoners of War on their way home. This arrangement came to an end on November 30th.

During the year 1918, 34,008 parcels were sent into Germany by the Committee. The number of Royal Army Medical Corps Prisoners of War already repatriated is 1,554, leaving only nine in German hands.

Forty-five Royal Army Medical Corps men died whilst in captivity, besides the eight who died in Turkey.

(5) The Director-General, Army Medical Services, sent us the following letter:—

War Office,
Adastral House,
Victoria Embankment, E.C. 4.
December 17, 1918.

Dear Madam,—The functions of the Care Committee having lapsed owing to the return of British Prisoners from all Theatres of War, I desire to take this opportunity on behalf of all ranks of the Corps, of expressing their deep and heartfelt appreciation of the untiring devotion displayed by all those ladies who so kindly assisted in the various branches connected with our Prisoners of War Fund. The work on which they have been engaged has been of inestimable benefit to our prisoners, and has inevitably been the means of alleviating much sickness and distress.

Yours faithfully,
T. H. Goodwin,
D.G.

Seventy-five copies of this letter were printed and one sent to each of our workers with a covering letter from Mrs. Buswell, in which she expressed her personal gratitude for their hearty co-operation, which alone enabled her to carry out her duties through a most strenuous time.

(6) Very cordial votes of thanks were proposed by Lady Goodwin and carried unanimously, to Mrs. C. K. Morgan who initiated the Fund and carried on the work of Honorary Secretary until her departure for America, to Mrs. Tilbury Brown, who continued the duties, and especially to Mrs. F. R. Buswell who undertook the position at a time when the large increase in the number of prisoners caused an enormous expansion in the labour, and who carried the Fund to a satisfactory conclusion.

Also to Lieut.-Colonel E. M. Wilson for acting as Honorary Treasurer and to Mr. E. T Gann who has kindly audited the accounts for successive years.

(7) A statement of accounts is being prepared and it will be a source of gratification to the subscribers that from first to last the Fund has been completely self-supporting.

(8) It was decided that the Credit Balance remaining should be divided between the General Relief Branches of the Royal Army Medical Corps Fund and the Auxillary Royal Army Medical Corps Fund in the proportion of one third to the former and two thirds to the latter for the benefit of the widows and orphans of the men of the Corps as a whole.

APPOINTMENT OF A MEDICAL OFFICER IN SAINT LUCIA.

The Secretary of State for the Colonies announces that a vacancy exists for a Medical Officer in Saint Lucia.

The appointment is temporary, and carries salary at the rate of £350 per annum; free quarters; free passage provided. Applicants should have had hospital experience and preferably also training in bacteriology. Private practice allowed.

Duration of appointment six months, with possibility of permanent appointment as a Medical Officer, Windward Islands.

Free return passage if engagement not continued.

Preference will be given to candidates under 35 years of age.

Further particulars and forms of application can be obtained from the Secretary for Appointments, Colonial Office, Downing Street, S.W. 1.

No testimonials should be forwarded until an application form has been obtained from the Colonial Office.

EXCHANGES, &c.

The charge for inserting Notices respecting Exchanges in the Royal Army Medical Corps is 5/- for not more than five lines, which should be forwarded by Cheque or P.O.O., with the notice, to Messrs. G. STREET and CO., Ltd., 8, Serle Street, London, W.C., not later than the 22nd of the month.

Lieut.-Colonel is willing to exchange for Service in India. Apply, "Chapman," c/o Holt's, 3, Whitehall Place, S.W. 1.

Captain R.A.M.C., regular, 9½ years' service, at present in India, 2½ years to complete foreign tour, desires exchange with regular officer in Hong Kong, Malta or Gibraltar, with not more than 2½ years to complete foreign tour. "K.C.," c/o G. Street & Co., 8, Serle Street, London, W.C. 2.

A free issue of twenty-five reprints will be made to contributors of Original Communications, and of twenty-five excerpts of Lectures, Travels and Proceedings of the United Services Medical Society.

Any demand for reprints, additional to the above, or for excerpts, must be forwarded at the time of submission of the article for publication, and will be charged for at the following rates, and additional copies at proportionate rates:—

Number of Reprints	Number of Pages	Cost of Reprints	Cost of Excerpts*	Extra for Covers for Reprints			
				As Journal, Printed on Front	As Journal, Plain, Unprinted	Cheaper Paper, Printed on Front	Cheaper Paper, Plain, Unprinted
		£ s. d.	£ s. d.	s. d.	s. d.	s. d.	s. d.
12	4	0 2 9	0 1 2				
	8	0 5 0	0 2 3	4 3	1 1	3 10	0 9
	16	0 8 3	0 3 11				
25	4	0 3 4	0 1 5				
	8	0 6 0	0 2 9	4 10	1 6	4 4	0 11
	16	0 10 6	0 5 0				
50	4	0 4 6	0 1 10				
	8	0 7 6	0 3 6	6 0	2 1	4 10	1 2
	16	0 13 3	0 5 10				
100	4	0 6 0	0 3 1				
	8	0 10 0	0 4 10	7 10	3 11	6 7	2 5
	16	0 18 6	0 7 6				
200	4	0 9 6	0 4 5				
	8	0 15 0	0 6 7	10 10	7 6	9 0	4 10
	16	1 6 0	0 9 8				

* These are not arranged as Reprints, but appear precisely as in the Journal with any other matter that may happen to appear on the first and last pages of the particular excerpt ordered.

Cases for Binding Volumes.—Strong and useful cases for binding can be obtained from the publishers at the undermentioned rates:—

Covers, 2s. 6d. net; binding, 2s. 6d.

These charges are exclusive of cost of postage.

In forwarding parts for binding the name and address of sender should be enclosed in parcel.

The above figures are subject to 25 per cent increase.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are

inserted free of charge to subscribers and members of the Corps. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "Journal of the Royal Army Medical Corps," 324, Adastral House, Victoria Embankment, E.C. 4.

The following publications have been received:—

British: Guy's Hospital Gazette, Edinburgh Medical Journal, The Ex-Service Men, The Journal of State Medicine, The Indian Journal of Medical Research, Publications of the South African Institute for Medical Research, The Royal Engineers' Journal, The Medical Press, The Hospital, The British Journal of Surgery, The Medical Review, Tropical Diseases Bulletin, The Medical Journal of Australia, The Indian Medical Gazette, The Journal of the Royal Army Service Corps, The Journal of Tropical Medicine and Hygiene, St. Bartholomew's Hospital Journal, Proceedings of the Royal Society of Medicine, Transactions of the Society of Tropical Medicine and Hygiene, Abstract of Bacteriology, Public Health, Veterinary Review, The Journal of the Royal Sanitary Institute, Journal of the United Service Institution of India, The Medical Journal of South Africa, Report of the Director-General of Public Health, New South Wales.

Foreign: Revue Interalliée, Les Mutilés de la Guerre, Bulletin de l'Institut Pasteur, Le Caducée, Office International d'Hygiène Publique, Colonies et Marine, Bulletin of the Johns Hopkins Hospital, Archives de l'Institut Pasteur de Tunis, United States Public Health Service, Bulletin de la Société de Pathologie Exotique, L'Ospedale Maggiore, Archives de Médecine et de Pharmacie Militaire, Giornale di Medicina Militare, Annali di Medicina Navale e Colonial, Archives de Médecine et Pharmacie Navales, Surgery, Gynæcology and Obstetrics.

MANAGER'S NOTICES.

The Journal of the Royal Army Medical Corps is published monthly, six months constituting one volume, a volume commencing on 1st July and 1st January of each year.

The Annual Subscription is £1 (which includes postage), and should commence either on 1st July or 1st January; but if a subscriber wishes to commence at any other month he may do so by paying for the odd months between 1st July and 1st January at the rate of 1s. 8d. (one shilling and eightpence) per copy. (All subscriptions are payable in advance.)

Single copies can be obtained at the rate of 2s. per copy.

The Corps News is also issued separately from the Journal, and can be subscribed for at the rate of 2s. (two shillings) per annum, including postage. Subscriptions should commence from 1st July each year; but if intending subscribers wish to commence from any other month, they may do so by paying for the odd months at the rate of 2d. per copy. (All subscriptions are payable in advance.)

Officers of the Royal Army Medical Corps possessing Diplomas in Public Health, etc., are kindly requested to register their special qualifications at the War Office. Letters of complaint are frequently received from officers stating that their special qualifications have not been shown in the Distribution List which is published as a supplement to the Journal in April and October of each year. As, however, the particulars of this list are supplied from official sources, officers are reminded that unless the possession of Diplomas, etc., has been registered at the War Office, no entry of such qualifications can be recorded in the Distribution List.

Letters notifying change of address should be sent to the Hon. Manager, "Journal of the Royal Army Medical Corps," 25, Adastral House, Victoria Embankment, E.C. 4, and must reach there not later than the 20th of each month for the alteration to be made for the following month's issue.

It is requested that all Cheques or Postal Orders for Subscriptions to the Journal, Corps News, Reprints, etc., be crossed "Holt & Co.," and made payable to the "Hon. Manager, Journal R.A.M.C.," and not to any individual personally.

All communications for the Hon. Manager regarding subscriptions, etc., should be addressed to

The Hon. Manager,
"Journal of the Royal Army Medical Corps,"
25, Adastral House, Victoria Embankment, E.C.4.

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

APRIL, 1919.

EXTRACTS FROM THE "LONDON GAZETTE."

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

March 3, 1919.

The King has been graciously pleased to give orders for the following appointments to the Most Honourable Order of the Bath for valuable services rendered in connexion with military operations in Mesopotamia. Dated January 1, 1919.

To be Additional Members of the Military Division of the Third Class, or Companions of the said Most Honourable Order:—

Lieut.-Col. and Brevet Col. Matthew Henry Gregson Fell, C.M.G., Royal Army Medical Corps.

St. James's Palace, S.W.

March 3, 1919.

The King has been graciously pleased to give orders for the following appointments to the Most Excellent Order of the British Empire, for valuable services rendered in connexion with military operations in Mesopotamia. The appointments to date from January 1, 1919:—

MESOPOTAMIA.

To be Commanders of the Military Division of the said Most Excellent Order:—

Lieut.-Col. (Temp. Col.) James Henry Robinson Bond, D.S.O., Royal Army Medical Corps.
Col. Sebert Francis St. Davids Green, M.B., Army Medical Service.
Lieut.-Col. William Byam Lane, C.I.E., Indian Medical Service.

To be Officers of the Military Division of the said Most Excellent Order:—

Major John Handfield Brunskill, D.S.O., Royal Army Medical Corps.
Temp. Capt. William Arthur Cardwell, M.B., Royal Army Medical Corps.
Major (Acting Lieut.-Col.) George Elliott Cathcart, Royal Army Medical Corps.
Capt. Robert Alexander Chambers, M.B., Indian Medical Service.
Temp. Capt. Llewellyn Wynne Davis, M.D., Royal Army Medical Corps.
Temp. Capt. Gerald Henry Davy, M.B., Royal Army Medical Corps.
Capt. John Richard Harris, Royal Army Medical Corps (Special Reserve).
Major Hector Lionel Howell, M.C., Royal Army Medical Corps,
Capt. Cuthbert Joseph Harwood Little, M.B., Royal Army Medical Corps.
Temp. Capt. Gerald Struan Marshall, Royal Army Medical Corps.
Capt. John Phimister Mitchell, M.B., Royal Army Medical Corps (Special Reserve).
Capt. John Joseph Harper Nelson, M.C., M.D., F.R.C.S.Edin., Indian Medical Service.
Capt. Cyril John Penny, Royal Army Medical Corps (Special Reserve).
Capt. Hugh Given Robertson, M.B., Royal Army Medical Corps.
Temp. Major Maitland Bodley Scott, F.R.C.S., Royal Army Medical Corps.
Capt. Frank Thomas Herbert Wood, M.B., Royal Army Medical Corps (Territorial Force).

War Office,

March 3, 1919.

His Majesty the King has been graciously pleased to approve of the undermentioned awards for distinguished service in connexion with military operations in Mesopotamia. Dated January 1, 1919:—

To be Major-General:—

Col. (Temp. Major-Gen.) A. P. Blenkinsop, C.B., C.M.G., Army Medical Service.

To be Brevet Colonel:—

(On Retired List, Reserve of Officers, Special Reserve, New Army or Territorial Force, in the case of Officers belonging to these categories as applicable.)

Major and Brevet Lieut.-Col. C. M. Goodbody, C.I.E., D.S.O., Indian Medical Service.

To be Brevet Lieutenant-Colonel:—

(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories, as applicable.)

Major T. G. F. Paterson, D.S.O., M.B., Indian Medical Service.

Major E. A. Roberts. D.S.O., Indian Medical Service.

To be Brevet Major:—

(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories as applicable.)

Capt. A. G. J. McIlwaine, C.I.E., Royal Army Medical Corps.

Temp. Capt. H. H. Raw, Royal Army Medical Corps.

Capt. A. Shepherd, M.B., Royal Army Medical Corps.

AWARDED THE MILITARY CROSS.

Temp. Capt. John Adam Gib Burton, M.B., Royal Army Medical Corps.

Capt. Cyril Reginald Knowles, Royal Army Medical Corps (Special Reserve).

Capt. Sidney William Rintoul, M.B., Royal Army Medical Corps (Special Reserve).

His Majesty the King has been graciously pleased to approve of the award of the Meritorious Service Medal to the undermentioned Warrant Officers and Non-commissioned Officers in recognition of valuable services rendered with the British Forces in Mesopotamia:—

ROYAL ARMY MEDICAL CORPS.

464004 Serjt. (Acting Staff-Serjt.) W. E. Dalling, 1st (Wessex Division) Sanitary Section (T.F.) (Ilfracombe).

545652 Serjt. P. Harrison, 1st London General Hospital (T.F.) (Uxbridge).

541039 Serjt. (Acting Staff-Serjt.) R. Hewitson, 3rd London General Hospital (T.F.) (Wallington).

12002 Qmr.-Serjt. (Acting Serjt.-Major) W. J. Knee (Clapton).

751 Staff-Serjt (Acting Qmr.) A. J. Milne, G.H.Qrs. (Aberdeen).

45175 Staff-Serjt. T. W. Rogers, Advanced Base (Sheffield).

St. James's Palace, S.W.,
March 5, 1919.

The King has been graciously pleased to make the following appointments to the Most Eminent Order of the Indian Empire for services in, and in connexion with, the military operations in Mesopotamia:—

To be Additional Companions of the said Most Eminent Order:—

Lieut.-Col. Philip Francis Chapman, M.B., Indian Medical Service.

Major and Brevet Lieut.-Col. Henry Joseph Crossley, Royal Army Medical Corps.

Major and Brevet Lieut.-Col. James Drummond Graham, Indian Medical Service.

Major and Brevet Lieut.-Col. William Haywood Hamilton, D.S.O., F.R.C.S., Indian Medical Service.

Major (Temp. Lieut.-Col.) Cuthbert Allan Sprawson, M.D., Indian Medical Service.

His Majesty the King has been graciously pleased to approve of the following Awards to the undermentioned Officers in recognition of their gallantry and devotion to duty in the Field.

The acts of gallantry for which the decorations have been awarded will be announced in the *London Gazette* as early as practicable.

AWARDED A FIRST BAR TO THE DISTINGUISHED ORDER.

Capt. (Acting Lieut.-Col.) William Ross Gardner D.S.O., Royal Army Medical Corps (Special Reserve), attached 138th Field Ambulance (D.S.O. gazetted January 1, 1918).

Canadian Force.

Lieut.-Col. Daniel Paul Kappelo, D.S.O., 5th Field Ambulance, Canadian Army Medical Corps (D.S.O. gazetted June 3, 1918).

Lieut.-Thomas McCrae Leazk, D.S.O., 10th Field Ambulance, Canadian Army Medical Corps (D.S.O. gazetted January 1, 1918).

AWARDED THE DISTINGUISHED SERVICE ORDER.

Capt. (Acting Lieut.-Col.) William Wallace Boyce, No. 2 Field Ambulance, Royal Army Medical Corps.

Capt. (Acting Lieut-Col.) William Hilgrove Leslie McCarthy, M.C., Royal Army Medical Corps (Special Reserve), attached 19th Field Ambulance.

Temp. Capt. Clarence Randolph Young, M.C., Royal Army Medical Corps, attached 1st Battalion Shropshire Light Infantry.

Australian Imperial Force.

Major Robert Fulton Craig, 15th Field Ambulance, Australian Army Medical Corps.

AWARDED A SECOND BAR TO THE MILITARY CROSS.

Temp. Capt. (Acting Major) George Rankine, M.C., D.A.D.M.S., 9th Division Royal Army Medical Corps (M.C. gazetted November 4, 1915) (First Bar gazetted July 26, 1988).

AWARDED A FIRST BAR TO THE MILITARY CROSS.

Temp. Capt. Michael Charles Burke, M.C., Royal Army Medical Corps, attached 2nd Battalion Durham Light Infantry (M.C. gazetted August 25, 1916).

Temp. Capt. George Milne Cameron, M.C., Royal Army Medical Corps (Territorial Force), attached 65th (W. Lancs.) Field Ambulance (M.C. gazetted July 26, 1918).

Lieut. (Temp. Capt.) William Haig Ferguson, M.C., M.B., Royal Army Medical Corps, attached 8th Battalion Royal Berks Rifles (M.C. gazetted September 16, 1918).

Lieut. (Acting Major) James La Fayette Lauder, D.S.O., M.C., 138th Field Ambulance, Royal Army Medical Corps (M.C. gazetted December 11, 1916).

Capt. (Acting Major) Herbert Bruce Low, M.C., 2/2nd (Northumberland) Field Ambulance, Royal Army Medical Corps (Territorial Force (M.C. gazetted January 10, 1917).

Temp. Capt. James Carter Ogilvie, M.C., Royal Army Medical Corps, attached 1st Battalion Border Rifles (M.C. gazetted September 16, 1918).

Temp. Capt. John Rodger, M.C., Royal Army Medical Corps, attached 1st Battalion Border Rifles (M.C. gazetted September 16, 1918).

Capt. (Acting Major) James Bethune Scott, M.C., Royal Army Medical Corps (Special Reserve), attached 16th Field Ambulance (M.C. gazetted October 18, 1917).

Temp. Capt. David Campbell Suttie, M.C., Royal Army Medical Corps, attached 1/2nd (North Midland) Field Ambulance, Royal Army Medical Corps (Territorial Force) (M.C. gazetted January 1, 1917).

Temp. Capt. Gwilym David Watkins, D.S.O., M.C., Royal Army Medical Corps, attached 2nd Battalion West Riding Rifles (M.C. gazetted January 1, 1918).

Temp. Capt. William Brickie Wilson, M.C., Royal Army Medical Corps, attached 1st Devonshire Rifles (M.C. gazetted December 2, 1918).

Canadian Force.

Capt. James Everett Barry, M.C., Canadian Army Medical Corps, attached 2nd Canadian Battalion E. Ontario Rifles (M.C. gazetted December 2nd, 1918).

Capt. Frederick Thomas Campbell, M.C., Canadian Army Medical Corps, attached 8th Canadian Battalion Manitoba Rifles (M.C. gazetted February 1, 1919).

Capt. Henry Clarke Davis, M.C., 10th Field Ambulance, Canadian Army Medical Corps (M.C. gazetted January 18, 1918).

Capt. Henry Clarke Moses, M.C., 5th Field Ambulance, Canadian Army Medical Corps (M.C. gazetted February 15, 1919).

AWARDED THE MILITARY CROSS.

Temp. Capt. Harold John Bensted, 140th Field Ambulance, Royal Army Medical Corps, attached 138th Field Ambulance.

Temp. Capt. Gravin Stiell Brown, M.B., Royal Army Medical Corps, attached 1/4th Leicester R.T. (Territorial Force).

Temp. Capt. (Acting Major) Samuel Burnside Boyd Campbell, M.B., 108th Field Ambulance, Royal Army Medical Corps.

Capt. John Sawers Clarke, M.B., Royal Army Medical Corps (Territorial Force), attached 15th Battalion Royal Irish Rifles.

Temp. Capt. George Oliver Connell, Royal Army Medical Corps, attached Headquarters R.E., 41st Division.

Temp. Capt. Cedric Lewis Dold, M.B., Royal Army Medical Corps, attached 1st Battalion South Wales Borderers.

Temp. Capt. (Acting Major) James Angus Doull, M.D., 103rd Field Ambulance, Royal Army Medical Corps.

Temp. Capt. (Acting Major) Stanley Fenwick, M.B., 16th Field Ambulance, Royal Army Medical Corps.

Capt. (Acting Major) William Douglas Frew, Royal Army Medical Corps (Territorial Force), attached 131st Field Ambulance.

Temp. Capt. Codanda Madieh Ganapathy, M.B., Indian Medical Service, attached Grenadiers, Imperial Army, Egypt.

Temp. Capt. George Alexander Conner Gordon, Royal Army Medical Corps, attached London Regiment.

Temp. Capt. Edward Harold Hertslet Granger, Royal Army Medical Corps, attached 1st Battalion Leicester Regiment.

Temp. Capt. Zachariah Albert Green, Royal Army Medical Corps, attached 7th Battalion, Wilts Regiment.

Temp. Capt. Alfred Purvis Hart, M.B., No. 2 Field Ambulance, Royal Army Medical Corps.

Temp. Lieut. William Hickey, M.B., Royal Army Medical Corps, attached 8th Battalion, East Surrey Regiment.

Temp. Capt. St. George Marriott Leslie Homan, M.B., Royal Army Medical Corps, attached 1/8th Battalion, Notts and Derby Regiment (Territorial Force).

Temp. Capt. George Jackson, Royal Army Medical Corps, attached 15th Battalion, Notts and Derby Regiment.

Temp. Capt. Malcolm Manson, M.B., Royal Army Medical Corps, attached 10th Battalion Royal West Surrey Regiment.

Lieut. Will George Frederick Owen-Morris, M.B., Royal Army Medical Corps (Special Reserve), attached 2nd Battalion Leins. Regiment.

Capt. (Acting Major) Harry Priest Rudolph, M.B., Royal Army Medical Corps, Egypt.

Temp. Capt. (Acting Major) Robert Bryson Rutherford, M.B., 91st Field Ambulance, Royal Army Medical Corps, attached 6th Division.

Lieut. Sohan Lall Bhatia, Indian Medical Service, attached Infantry, Imperial Army, Egypt.

Lieut. (Temp. Capt. and Acting Major) Gerald Evan Spicer, 107th Field Ambulance, Royal Army Medical Corps.

Temp. Capt. Frederick Reginald Sturridge,. Royal Army Medical Corps, attached 2nd Royal Scottish Fusiliers.

Temp. Capt. (Acting Major) Christopher Sullivan, 75th Field Ambulance, Royal Army Medical Corps.

Temp. Capt. Edward Cowper Tamplin, Royal Army Medical Corps, attached 9th Battalion Scottish Rifles.

Capt. James Thompson, M.B., Royal Army Medical Corps, attached 2nd Battalion Bedford Regiment.

Temp. Capt. William Tudhope, M.B., 17th Field Ambulance, Royal Army Medical Corps.

Temp. Capt. (Acting Major) Alexander Wilmot Uloth, 132nd Field Ambulance, Royal Army Medical Corps.

Temp. Capt. Robert William Lessel Wallace, M.D., Royal Army Medical Corps, attached 9th Battalion East Surrey Regiment.

Capt. (Acting Major) Michael White, M.B., No. 1 Field Ambulance, Royal Army Medical Corps.

Capt. Henry Parks Whitworth, Royal Army Medical Corps (Special Reserve), attached 6th Battalion K.O. Scottish Borderers.

Canadian Force.

Capt. (Acting Major) Henry Merril Barrett, No. 2 Field Ambulance, Canadian Army Medical Corps.

Capt. Lambert Douglas Densmore, Canadian Army Medical Corps, attached No. 1 Field Ambulance.

Capt. Albert Grant Fleming, Canadian Army Medical Corps, attached 4th Canadian Infantry Battalion.

Capt. Frederick McNab Johnson, Canadian Army Medical Corps, attached No. 2 Field Ambulance.

Capt. Gladstone Wilfred Lougheed, 4th Field Ambulance, Canadian Army Medical Corps.

Capt. Allan Young McNair, Canadian Army Medical Corps, attached 10th Infantry Battalion Alberta Regiment.

Qmr. and Capt. John Eunson Tulloch, 10th Field Ambulance, Canadian Army Medical Corps.

Capt. Rene Edward Ames Weston, Canadian Army Medical Corps, attached 2nd Canadian Field Ambulance.

Australian Imperial Force.

Capt. Leslie Thomas Allsop, 10th Field Ambulance, Australian Army Medical Corps, attached 39th Battalion Australian Infantry.

Capt. Joseph Ringland Anderson, Australian Army Medical Corps, attached 45th Battalion Australian Infantry.

Capt. William Johnstone Binns, Australian Army Medical Corps, attached 33rd Battalion Australian Infantry.

Capt. Arthur Poole Lawrence, 6th Field Ambulance, Australian Army Medical Corps.

Capt. Edward Albert Woodward, 8th Field Ambulance, Australian Army Medical Corps, attached 29th Battalion Australian Infantry

South African Force.

Temp. Capt. Gideon Albertyn Beyers, South African Medical Corps, attached 1st Battalion South African Infantry.

Temp. Capt. Henry Ruthven Lawrence, 1st Field Ambulance, South African Medical Corps.

War Office,
March 11, 1919.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for distinguished services rendered during the course of the campaign.

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

Decorations and Medals conferred by:—

THE PRESIDENT OF THE FRENCH REPUBLIC.

Legion d'Honneur. Croix de Chevalier.

Lieut.-Col. (Temp. Col.) Harold Collinson, C.M.G., D.S.O., M.B., F.R.C.S., Royal Army Medical Corps (Territorial Force).

Major (Temp. Lieut.-Col.) David Rorie, D.S.O., M.D., Royal Army Medical Corps (Territorial Force).

Capt. (Acting Major) James Martin Smith, M.C., M.B., Royal Army Medical Corps (Territorial Force),

Croix de Guerre.

Col. Arthur Evans Snell, C.M.G., D.S.O., Canadian Army Medical Corps.

Medaille Militaire.

56157 Pte. Walter Boyd, 1/2nd Highland Field Ambulance, Royal Army Medical Corps (Honley, near Huddersfield).

Decorations and Medals conferred by:—

HIS MAJESTY THE KING OF ITALY.

ORDER OF THE CROWN OF ITALY.

Officer.

Lieut.-Col. Robert Welland Knox, D.S.O., M.B., Indian Medical Service.
Lieut.-Col. John Kyffin, Royal Army Medical Corps (Territorial Force).

Croce di Guerra.

Temp. Capt. Thomas Warren Mason, Royal Army Medical Corps (Territorial Force).

439279 Pte. (Acting Cpl.) Percy Thomas Holbrook, 1/3rd South Midland Field Ambulance, Royal Army Medical Corps (Territorial Force) (Bristol).

War Office,
March 12, 1919.

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Distinguished Conduct Medal to the undermentioned Non-commissioned Officer for gallantry and distinguished service in the Field. The act of gallantry for which the decoration has been awarded will be announced in the *London Gazette* as early as practicable:—

435120 Staff-Serjt. F. G. Burling, D.C.M., 2/1st (South Midland) Field Ambulance, Royal Army Medical Corps (Territorial Force), (Birmingham).

His Majesty the King has been graciously pleased to approve of the Distinguished Conduct Medal to the undermentioned Non-commissioned Officers and Man for gallantry and distinguished service in the Field. The acts of gallantry for which the decorations have been awarded will be announced in the *London Gazette* as early as practicable:—

67165 Cpl. G. Barlow, 96th Field Ambulance, Royal Army Medical Corps (Manchester).

350477 Pte. G. Barnett, 2/1st (East Lancs.) Field Ambulance, Royal Army Medical Corps (Territorial Force), (Brighton).

510019 Serjt. G. Biddle, M.M., 2/2nd (London) Field Ambulance, Royal Army Medical Corps (Territorial Force), (Walworth).

534450 Serjt. W. S. Harrington, 14th Field Ambulance, Royal Army Medical Corps (Hammersmith).

32220 Cpl. (Acting Serjt.) W. N. Haseldine, M.M., 28th Field Ambulance, Royal Army Medical Corps (Earlestown).

435039 Cpl. G. G. Zissman, 2/1st (South Midland) Field Ambulance, Royal Army Medical Corps (Territorial Force), (Birmingham).

52775 Serjt. H. C. J. Munson, 140th Field Ambulance, Royal Army Medical Corps (Hither Green).

CANADIAN FORCE.

533055 Serjt. J. E. Doyle, 1st Canadian Field Ambulance, Canadian Army Medical Corps.

War Office,
March 13, 1919.

The names of the undermentioned have been brought to the notice of the Secretary of State for War for valuable services rendered on the occasion of the sinking or damage by enemy action of Hospital Ships, Transports and Store Ships:—

Temp. Capt. (Acting Lieut.-Col.) G. W. Milne, Royal Army Medical Corps.
Temp. Capt. W. G. Silvester, Royal Army Medical Corps.
Temp. Capt. T. D. Webster, Royal Army Medical Corps.
100015 Pte. (Acting Lance-Cpl.) J. Booth, Royal Army Medical Corps.
28519 Pte. (Acting Cpl.) J. B. Brown, Royal Army Medical Corps.
64178 Serjt. (Acting Serjt.-Major) M. C. Gordon, Royal Army Medical Corps.
102681 Pte. J. A. Hamer, Royal Army Medical Corps.
81707 Pte. (Acting Cpl.) A. D. Johnston, Royal Army Medical Corps.
81357 Pte. (Acting Cpl.) H. W. Webster, Royal Army Medical Corps. (Died.)

The names of the undermentioned Officers, Warrant Officers, and Non-commissioned Officers have been brought to the notice of Secretary of State for War for valuable services rendered on Hospital Ships during the War:—

Temp. Major W. G. K. Barnes, M.D. (formerly Deputy Surg.-Gen., R.N.), Royal Army Medical Corps.
Major A. Bird, Royal Army Medical Corps (Territorial Force).
Temp. Major J. A. Devine, D.S.O., M.D., Royal Army Medical Corps.
Lieut.-Col. I. B. Emerson, Royal Army Medical Corps (R.P.).
Capt. (Acting Major) H. F. Everett, Royal Army Medical Corps (Territorial Force).
Lieut.-Col. (Temp. Col.) R. S. H. Fuhr, C.M.G., D.S.O., Royal Army Medical Corps.
Lieut.-Col. P. B. Haig, C.B., M.B., Indian Medical Service.
Temp. Capt. D. J. Jones, Royal Army Medical Corps.
Temp. Major T. M. Kendall, Royal Army Medical Corps.
Lieut.-Col. C. W. S. Magrath, M.D., Royal Army Medical Corps.
Lieut.-Col. C. Milne, M.B., Indian Medical Service.
Temp. Capt. H. T. L. Roberts, Royal Army Medical Corps.
Temp. Capt. W. V. Robinson, Royal Army Medical Corps.
Lieut.-Col. E. W. Sibery, Royal Army Medical Corps.
Temp. Capt. A. G., Southcombe, M.D., Royal Army Medical Corps.
Temp. Capt. W. H. Stott, Royal Army Medical Corps.
Major F. C. Whitmore, Royal Army Medical Corps (Territorial Force).
Temp. Major R. Wilson, Royal Army Medical Corps.
Temp. Major S. W. Woollett, Royal Army Medical Corps.
1336 Serjt. (Acting Serjt.-Major) C. Dovey, Royal Army Medical Corps.
12429 Staff-Serjt. (Acting Serjt.-Major) F. J. Ferguson, Royal Army Medical Corps.
17937 Qmr.-Serjt. (Acting Serjt.-Major) P. A. Kirby, Royal Army Medical Corps.
16474 Qmr.-Serjt. (Acting Serjt.-Major) W. Lowery, Royal Army Medical Corps.
2106 Staff-Serjt. (Acting Serjt.-Major) J. Macdonald, Royal Army Medical Corps.
12018 Qmr.-Serjt. (Acting Serjt.-Major) F. G. Phipps, Royal Army Medical Corps.
16564 Qmr.-Serjt. (Acting Serjt.-Major) C. Vickers, Royal Army Medical Corps.
18234 Serjt. (Acting Serjt.-Major) W. Vincent, Royal Army Medical Corps.

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Military Medal to the undermentioned Non-commissioned Officers and Men:—

Bar to Military Medal.

534184 Pte. (Acting Cpl.) F. Barlow, M.M., 4th (London) Field Ambulance, Royal Army Medical Corps (Boston). (M.M. gazetted September 14, 1916.)

538064 Serjt. T. A. Sullivan, M.M., 6th (London) Field Ambulance, Royal Army Medical Corps (Fulham). (M.M. gazetted December 9, 1916.)

34207 Pte. (Acting Lance-Cpl.) J. Charnley, M.M., Royal Army Medical Corps (Wernith). (M.M. gazetted July 18, 1917.)

536567 Cpl. T. R. Cutting, M.M., 5th (London) Field Ambulance, Royal Army Medical Corps (Lewisham). (M.M. gazetted August 16, 1917.)

7285 Pte. W. Crossley, M.M., Royal Army Medical Corps (Clapton). (Salonika.) (M.M. gazetted September 28, 1917.)

20551 Pte. (Acting Lance-Cpl.) M. Reed, M.M., Royal Army Medical Corps (Kendal).

3782 Pte. (Acting Lance-Cpl.) J. R. Wells, M.M. Royal Army Medical Corps (Landport). (M.M. gazetted February 23, 1917.)

318033 Serjt. J. Johnston, M.M., 2nd Field Ambulance, Royal Army Medical Corps (Partick). (M.M. gazetted April 25, 1918.)

881 Cpl. (Acting Serjt.) H. David, M.M., Royal Army Medical Corps (Carthay). M.M. gazetted in present *Gazette*.

His Majesty the King has been graciously pleased to approve of the award of the Military Medal for bravery in the Field to the undermentioned Non-commissioned Officers and Men:—

ROYAL ARMY MEDICAL CORPS.

459025 Staff-Serjt. F. C. Roach, Royal Army Medical Corps (Plymouth).
510021 Serjt. A. V. Baker, Royal Army Medical Corps (London, S.W.). (Salonika).
8666 Serjt. (Acting Serjt.) A. J. Bonser, 66th Field Ambulance (Much Wenlock). (Salonika.)
352224 Serjt. F. Heap, Royal Army Medical Corps (Ellam).
90958 Serjt. E. W. Hill, 99th Field Ambulance (Ledbury).
315095 Serjt. A. McNiven, Royal Army Medical Corps (Glasgow).
34858 Serjt. (Acting Staff-Serjt.) H. J. D. Porter, 95th Field Ambulance (Dalston).
93594 Serjt. G. D. Smith, 90th Field Ambulance (Cardiff).
47876 Serjt. (Acting Staff-Serjt.) W. T. Sayer, 54th Field Ambulance (Ramsgate).
4516 Serjt. A. Steer, Royal Army Medical Corps (Cork).
497289 Cpl. (Acting Serjt.) A. W. Bayly, Royal Army Medical Corps (Bisley).
545576 Cpl. (Acting Serjt.) E. Franklin, 38th Sanitary Section (Ilford).
510103 Cpl. A. R. Gatward, Royal Army Medical Corps (Harringay). (Salonika).
320187 Cpl. J. A. McMurtrie, 3rd Field Ambulance (Edinburgh).
37894 Cpl. J. Romeril, 53rd Field Ambulance (Guernsey).
512031 Cpl. A. A. Slade, 85th Field Ambulance (London, S.W.). (Salonika).
362080 Cpl. G. J. Underwood, Royal Army Medical Corps (Chester).
20795 Cpl. W. H. Wallace, D.C.M., 18th Field Ambulance (Manchester).
5828 W. H. Arton, 55th Field Ambulance (Cosham).
37005 Pte. E. Amos, 5th Cavendish Field Ambulance (Leeds).
38002 Pte. (Acting Lance-Cpl.) J. Anderson, 51st Field Ambulance (Wellington Quay).
320223 Pte. G. Augus, 3rd Field Ambulance (Leith).
45536 Pte. A. Baker, 37th Field Ambulance (Turners Hill).
1101 Pte. L. Burnacott, 56th Field Ambulance (London, S.W.).
57664 Pte. M. W. Bell, 141st Field Ambulance (Burton Stather).
67013 Pte. S. Brooks, 6th Field Ambulance (Elton Bury).
8250 Pte. J. R. Buckley, 4th Field Ambulance (E.) (Ashton-under-Lyne).
62203 Pte. C. Bulmer, 55th Field Ambulance (Leeds).
36487 Pte. H. Burke, 8th Field Ambulance (Bury).
68463 Pte. A. J. Burling, 90th Field Ambulance (Forest Gate, E.).
12348 Pte. A. Cade, 99th Field Ambulance (Ilkestone).
105607 Pte. B. Clegg, 56th Field Ambulance (Oldham).
401494 Pte. R. W. Coates, Royal Army Medical Corps (South Shields).
61961 Pte. F. Connolly, Royal Army Medical Corps (Bolton).
90238 Pte. J. Coyne, 18th Field Ambulance (East Glasgow).
37106 Pte. F. G. Curtis, 8th Field Ambulance (St. Pancras, W.C.).
61122 Pte. C. Devonhill, 68th Field Ambulance (Stafford).
1876 Pte. F. M. Elliott, 141st Field Ambulance (Sydenham).
57970 Pte. R. Elliot, 141st Field Ambulance (Newcastle-on-Tyne).
39727 Pte. A. D. Fidler, 14th Field Ambulance (Colden Common).
536399 Pte. (Acting Lance-Cpl.) P. W. Gardner, 5th Field Ambulance (Shepherd's Bush, W.).
32809 Pte. H. Gilbert, 99th Field Ambulance (Tunbridge Wells).
500257 Pte. J. H. Gosden, 6th Field Ambulance (Worthing).
63431 Pte. F. H. Gough, 67th Field Ambulance (Chase Terrace). (Salonika.)
534511 Pte. A. C. Gurry, 4th Field Ambulance (Camberwell, S.E.).
31615 Pte. D. Harmer, 44th Field Ambulance (Hoxton).
580 Pte. J. Higgins, Royal Army Medical Corps (E. Aldershot).
53802 Pte. (Acting Lance-Cpl.) J. Hill, 6th Field Ambulance (Collier's Wood, S.W.).
457453 Pte. W. B. Hoare, 56th Field Ambulance (Devon).
320063 Pte. L. Horsburgh, 3rd Field Ambulance (Edinburgh).
354182 Pte. H. Johnstone, 44th Field Ambulance (Manchester).
45992 Pte. D. Kelsey, 142nd Field Ambulance (Spennymoor).
66624 Pte. F. G. Lines, 99th Field Ambulance (Stony Stratford).
386544 Pte. R. A. Little, Royal Army Medical Corps (Newcastle-on-Tyne). (Salonika.)
328071 Pte. C. P. Lyle, 3rd Field Ambulance (Kilbarchan).
55596 Pte. J. Martin, Royal Army Medical Corps (Bolton).
66166 Pte. F. Mason, 80th Field Ambulance (Worcester). (Salonika.)
316235 Pte. J. McCartney, 1st Field Ambulance (Glasgow).
20665 Pte. R. McLean, Royal Army Medical Corps (Widnes).
53660 Pte. R. W. McLean, Royal Army Medical Corps (Glasgow).
50627 Pte. J. M. Norrie, 53rd Field Ambulance (Blairgowrie).
3537 Pte. J. H. Palmer, 2nd Field Ambulance (Godalming).
41774 Pte. (Acting Serjt.) W. J. Pearce, 78th Field Ambulance (Bloenrhondda). (Salonika.)

495329 Pte. G. T. Prescott, Royal Army Medical Corps (Canterbury).
5591 Pte. B. H. Price, 141st Field Ambulance (Wolverhampton).
3402 Pte. F. Price, 2nd Field Ambulance (E. Woolwich).
320041 Pte. T. A. Pullen, 3rd Field Ambulance (Edinburgh).
80042 Pte. E. W. Rashbrook, 18th Field Ambulance (Wandsworth).
305116 Pte. G. Reid, Royal Army Medical Corps (Glasgow).
58321 Pte. J. W. Ricon, 142nd Field Ambulance (Thorne).
7876 Pte. H. J. Robshaw, 99th Field Ambulance (Edmonton, N.).
337730 Pte. A. Roonley, 63rd Field Ambulance (Portwood).
512106 Pte. (Acting Cpl.) A. E. Severn, 85th Field Ambulance (Shepherd's Bush). (Salonika.)
1228 Pte. P. E. Smith, Royal Army Medical Corps (Bracknell).
7089 Pte. G. D. Tester, 8th Field Ambulance (Hove).
73893 Pte. F. C. Thomas, 142nd Field Ambulance (Greetland).
538112 Pte. W. H. Trump, 6th Field Ambulance (Broad Clyst).
76403 Pte. E. S. Tyler, 67th Field Ambulance (Woodhall Spa). (Salonika.)
3019 Pte. (Acting Lance-Cpl.) W. Underwood, 14th Field Ambulance (Aberdeen).
62591 Pte. (Acting Lance-Cpl.) A. Walker, 93rd Field Ambulance (Glaston).
50232 Pte. C. J. L. Waterfield, 142nd Field Ambulance (Wellinborough).
320108 Pte. R. Watt, 3rd Field Ambulance (Edinburgh).
538075 Pte. R. Whitaker, 6th Field Ambulance (West Brompton, S.W.).
354 Pte. (Acting Cpl.) A. Whitton, 2nd Field Ambulance (Glasgow).

AMENDMENTS.

The following are the correct descriptions of men whose names have appeared in the *London Gazette* for the award of the Military Medal:—

32439 Pte. A. E. Rivers, attached 2/1st (High.) Field Ambulance, Royal Army Medical Corps (Territorial Force).

79505 Pte. J. Sayers, 2/3rd (West Riding) Field Ambulance, Royal Army Medical Corps (Territorial Force).

47867 Pte. T. Scholes, 2/3rd (West Riding) Field Ambulance, Royal Army Medical Corps (Territorial Force).

47810 Pte. (Acting Serjt.) H. G. Scorer, 141st Field Ambulance, Royal Army Medical Corps. (Gazetted as H. C. Scorer.)

The amendments in the *London Gazette*, dated December 11, 1918, should read:—

42231 Pte. J. James, Royal Army Medical Corps.

ARMY MEDICAL OFFICERS' WIDOWS AND ORPHANS FUND.

THE Annual General Meeting of Members of this Society will be held at the War Office, Adastral House, in Room 322 (which Major-Gen. Sir W. Leishman has kindly lent), on Wednesday, May 21, at 3 o'clock. It will be followed by a Special General Meeting to consider a proposed amendment of the rules.

3, *Homefield Road,*
Wimbledon.
April 15, 1919.

J. T. CLAPHAM, *Captain,*
Secretary.

ROYAL ARMY MEDICAL CORPS CENTRAL MESS FUND.

THE Annual General Meeting of Subscribers to the Royal Army Medical Corps Central Mess Fund will be held in the Library of the Royal Army Medical College on Wednesday, June 11, 1919, following immediately that of the Royal Army Medical Corps Officers' Benevolent Society. The Director-General will preside. Officers desiring information about this Fund are asked to communicate with the Honorary Secretary beforehand, so that there may be no delay in dealing with any questions which may be asked. Notice of any definite proposal which it may be desired to bring forward should be sent to the Honorary Secretary in order that it may appear on the agenda paper.

3, *Homefield Road,*
Wimbledon, S.W.

J. T. CLAPHAM, *Captain,*
Honorary Secretary.

ROYAL ARMY MEDICAL CORPS CENTRAL MESS FUND.

CASH STATEMENT FOR THE YEAR ENDED FEBRUARY 28, 1919.

Dr. — *Income.*

Date	Income	£	s.	d.
1918 Mar. 1.	To Balance of Cash brought forward from 1917-1918	573	8	8
	,, Interest on Investments (after deducting Income Tax at 6s. in the £)	45	9	5
	,, Sale of £200 six per cent Exchequer Bonds 1920 (including Interest thereon)	207	3	5
	,, Subscriptions of Members (745)	543	2	8
	,, Entrance Fees at £5 5s. (22)	115	10	0
		£1,484	14	2

Cr. — *Expenditure.*

Date	Expenditure	£	s.	d.	£	s.	d.
1918 March.	By Grants to Messes: London	79	4	6			
	Aldershot	60	0	0			
	Tidworth	10	0	0			
					149	4	6
	,, Joining and difference-in-rank Contributions Paid to Messes on behalf of Subscribers— Aldershot				10	18	0
	,, Purchase of £700 five per cent. National War Bonds, 1928				700	0	0
	,, Refund of Subscription ..				0	8	3
	,, Management Expenses— Auditor's Fee ..	3	3	0			
	Printing, Typing, Postage, etc. ..	4	19	11			
					8	2	11
1919 Feb. 28.	Balance of Cash carried forward to 1919-20				616	0	6
					£1,484	14	2

BALANCE SHEET AT FEBRUARY 28, 1919.

Liabilities.

Liabilities	£	s.	d.
Royal Army Medical Corps Entertainment Fund, Sierra Leone, held for ..	14	14	1
Balance	2,392	1	5
	£2,406	15	6

Assets.

Assets	£	s.	d.
Investments (valued at middle published prices on February 28, 1919)—			
£1,150 five per cent War Loan 1929-47	1,092	10	0
£700 five per cent National War Bonds, 1928	698	5	0
Cash at Bankers	616	0	6
	£2,406	15	6

Audited and found correct

April 2, 1919. (Signed) EDMOND T. GANN.

(Signed) J. T. CLAPHAM, *Captain*,
Hon. Secretary.

AUXILIARY ROYAL ARMY MEDICAL CORPS FUNDS.

The usual Quarterly Committee Meeting was held on Friday, April 4, at 11, Chandos Street, Cavendish Square, W. 1. Three grants were made to cases in the Benevolent Branch to Officers, and two grants to cases in the Relief Branch for the rank and file.

These Funds are for the relief of widows and orphans of commissioned officers and non-commissioned officers and men of the rank and file of the Royal Army Medical Corps, Special Reserve, Territorial Force and New Armies, and also for the relief of the children of those who have been so severely damaged in the present war that they need help for the education of children.' Requests for relief should be addressed to the Hon. Secretary, Sir William Hale-White, at the Offices of the Funds at 11, Chandos Street, Cavendish Square, W. 1.

ROYAL ARMY MEDICAL CORPS FUND (REGULAR ARMY) AND ROYAL ARMY MEDICAL CORPS OFFICERS' BENEVOLENT SOCIETY (REGULAR ARMY).

The Annual General Meeting of the Royal Army Medical Corps Fund will be held in the Library of the Royal Army Medical Corps College, Grosvenor Road, S.W., at 2.30 p.m., on Wednesday, June 11, 1919. The Director-General will preside. It is hoped that all subscribers who can spare the time will be present, and will freely express their views on any point connected with the Fund.

The Annual General Meeting of the Royal Army Medical Corps Benevolent Society will take place immediately afterwards.

Any officers desiring information regarding these Funds are requested to communicate with the Secretary beforehand, so that there may be no delay in dealing with any questions asked.

124, *Victoria Street, S.W.*
April 16.

E. M. Wilson, *Lieutenant-Colonel,*
Secretary.

THE ASSOCIATION OF MILITARY SURGEONS OF THE UNITED STATES.

At a recent meeting of the Council of the Association of Military Surgeons of the United States, it was decided in accordance with the provision of Section 5, Article III. of the constitution of this Association that associate membership should be thrown open to foreign officers of the medical service. Associate membership in the Association may be acquired on application to the Executive Council, the admission fee simply being $5.00, accompanying the application for membership and the annual dues thereafter $1.00, due on the 1st of January of each year, or $4.00 annually if subscription to the *Military Surgeon* is desired. The privilege of associate membership is cordially extended to any officer of the Royal Army Medical Corps who may be desirous of joining the Association of Military Surgeons of the United States, in aid of promoting closer relations among the British and American Armies.

ARMY MEDICAL OFFICERS' WIDOWS AND ORPHANS FUND.

NOTICE.

At a meeting of the Committee of this Society held on January 16, 1919, it was resolved unanimously, on the advice of the Consulting Actuary, that the present extra war premium for new entrants into the Society be suspended until further notice.

This Fund provides annuities of £50 a year during widowhood, to the widows of officers who have held permanent commissions in the Royal Army Medical Corps. In the event of the death of the widow this annuity is continued to the children of such marriage uutil the youngest attains the age of 21 years. It also continues for their benefit, up to the same age, if the widow re-marries. Furthermore, should the wife of the subscriber predecease him, it will be optional for him to continue the subscription he had been paying as a married member, in order to provide an annuity similar to the above for the children of the marriage, until the youngest shall have attained the age of 21 years.

Provision is also made whereby a part of the surplus at any quinquennial valuation may be applied for the benefit of members, or their widows, or orphan children. Thus, by the appropriations of surplus at the valuations of December 31, 1910 and 1915, the prospective widows of first-class married members on the books at those dates will receive, during this current quinquennium, £200 and £100 respectively at the death of their husbands, their annuities being also increased to the statutory limit of £52.

Unmarried members pay an annual subscription of £2, and on passing to the married class are allowed the equivalent of all past subscriptions in the unmarried class by way of reduction of their annual subscription in the married class. Examples of the annual subscription for married members are:—

Husband's age		Wife's age		Annual subscription
25	..	20	..	£13 8 5
30	..	27	..	£14 6 1
36	..	33	..	£16 17 2
46	..	40	..	£22 12 6
50	..	45	..	£24 9 5

The Secretary will be glad to give any further information as to details.

3, *Homefield Road,*
Wimbledon, S.W. 19,
April, 1919.

J. T. Clapham *Captain,*
Secretary.

FAREWELL MESSAGE FROM G.O.C. GUARDS DIVISION.

The following is a message of farewell from the General Officer commanding the Guards Division to the R.A.M.C. who had been doing duty with that Division throughout the war:—

It is with great regret that I send you this message of farewell on the dispersal of the Guards Division.

The three Field Ambulances now with the Division have shared its fortunes since its formation in 1915, and no units have served it more devotedly from that time to the present.

The care of the wounded when the Division has been in battle, and of the sick when it has been at rest, has earned for them the admiration and gratitude of all ranks.

Neither peril, discomfort nor fatigue have deterred them, and especially the officers and men of stretcher sections, from setting an example of bravery, endurance and devotion to duty unsurpassed in any other Division or any other service.

I would particularly like to express the gratitude felt alike by officers and men to the Medical Officers attached to the Battalions and to the Artillery. Whilst other officers have been given a rest, their labours have been unceasing, and the casualties in their ranks tell their own tale of heroism and unselfishness.

The skilled direction with which the Medical Services have been administered has added greatly to the comfort of the troops, and has been largely instrumental in maintaining the fighting efficiency of the Division.

I thank you all for your loyalty, gallantry and devotion during the past years, and wish you all the best of luck in the future.

March 5, 1919.

ROYAL ARMY MEDICAL COLLEGE.

LIST OF BOOKS ADDED TO THE LIBRARY DURING THE MONTHS OF JANUARY, FEBRUARY AND MARCH, 1919.

Title of Work and Author	Edition	Date	How obtained
Anatomy, Descriptive and Applied. By Henry Gray, F.R.S., F.R.C.S. Edited by Robert Howden, M.A.	20th	1918	Library Grant.
The Natural Organic Colouring Matters. By A. G. Perkin and A. E. Everest		1918	,, ,,
The Mayo Clinic. Vol. ix, 1917		1918	,, ,,
Chemical Pathology. By H. Gideon Wells, M.D. ..	3rd	1918	,, ,,
Radiography and Radio-Therapeutics. By Robert Knox, M.D. Part 2: Radio-Therapeutics		1918	,, ,,
Human Anatomy, including Structure and Development and Practical Considerations. By Various Authors. Edited by George A. Piersol	6th	1918	,, ,,
Diseases of the Eye. By J. H. Parsons	3rd	1918	,, ,,
The Practice of Surgery. By Russell Howard	2nd	1918	,, ,,
A Laboratory Guide in Histology. By L. B. Arey ..		1917	,, ,,
A Manual of Normal Histology and Organography. By Charles Hill, M.D.	3rd	1914	,, ,,
The Wassermann Test. By Charles F. Craig, M.D. ..		1918	,, ,,
Principles of General Physiology. By W. M. Bayliss, M.A., F.R.S.	2nd	1918	,, ,,
War Wounds of the Lung. By Pierre Duval		1918	,, ,,
Surgery at a Casualty Clearing Station. By Cuthbert Wallace, C.M.G., and John Fraser, M.C.		1918	,, ,,
War Surgery: From Firing Line to Base. By Basil Hughes, D.S.O., and H. Stanley Banks		1918	,, ,,
Surgery in War. By Lieut.-Col. A. J. Hull, R.A.M.C. ..	2nd	1918	,, ,,
The Hearts of Man. By R. M. Wilson, M.B.		1914	,, ,,
Researches on Egyptian Bilharziosis. By R. T. Leiper, M.D.		1918	,, ,,
Human Intestinal Protozoa in the Near East. By Lieut.-Col. C. M. Wenyon, R.A.M.C., and Capt. F. W. O'Connor, R.A.M.C.		1917	,, ,,
Tropical Medicine and Hygiene. By C. W. Daniels, M.B. Part III		1917	,, ,,
Lice and their Menace to Man. By Lieut. L. L. Lloyd, R.A.M.C.(T.)		1919	,, ,,
Field Sanitation. By Major St. J. MacDonald, C.A.M.C.		1918	,, ,,
A Laboratory Handbook of Bacteriology. By Prof. R. Abel. Translated by M. H. Gordon	2nd	1912	,, ,,
Military Medical Manual Series:—			
Wounds of the Abdomen. By J. Abadie. Edited by Sir W. Arbuthnot Lane		1918	,, ,,
Disabilities of the Locomotor Apparatus. By Aug. Broca. Edited by Sir Robert Jones		1918	,, ,,
Wounds of the Skull and Brain. By Chatelin and De Martel. Edited by F. F. Burghard		1918	,, ,,
Wounds of the Pleura and Lung. By Gregoire and Courcoux. Edited by C. H. Fagge		1919	,, ,,
Fracture of the Lower Jaw. By Imbert and Real. Edited by J. F. Colyer		1918	,, ,,
Treatment of Fractures. By R. Leriche. Edited by F. F. Burghard. 2 Vols.		1918	,, ,,

LIST OF BOOKS ADDED TO THE LIBRARY—*Continued.*

Title of Work and Author	Edition	Date	How obtained
Military Medical Manual Series—*Continued.*			
Localization and Extraction of Projectiles. By Ombrédanne and Ledoux-Lebard. Edited by F. F. Burghard		1918	Library Grant.
Wounds of the Vessels. By L. Sencert. Edited by F. F. Burghard		1918	,, ,,
Electro-diagnosis in War. By Zimmern and Perol. Edited by E. P. Cumberbatch		1918	,, ,,
The Clinical Forms of Nerve Lesions. By A. Benisty. Edited by E. Farquhar-Buzzard		1918	,, ,,
The Treatment and Repair of Nerve Lesions. By A. Benisty. Edited by E. Farquhar-Buzzard		1918	,, ,,
Dysenteries, Cholera and Exanthematic Typhus. By Vincent and Muratet. Edited by Col. A. Balfour and G. C. Low		1917	,, ,,
War Otitis and War Deafness. By Bourgeois and Sourdille. Edited by J. Dundas Grant		1918	,, ,,
Abnormal Forms of Tetanus. By Courtois-Suppit and Giroux. Edited by Surg.-Gen. Sir D. Bruce and F. Golla		1918	,, ,,
Mental Disorders of War. By Jean Lepine. Edited by Charles Mercier		1919	,, ,,
Malaria in Macedonia. By Armand-Delille, Abrami, Paisseau and Lemaire. Edited by Sir Ronald Ross		1918	,, ,,
Parasitology. Index to Volumes i to x		1918	,, ,,
Fractures and Dislocations. By Lewis A. Stimson, M.D.	8th	1917	,, ,,
Reminiscences of a Student's Life at Edinburgh in the Seventies. By "Alisma"		1918	,, ,,
A Short Italian Dictionary. By Alfred Hoare. Vol. i. Italian-English		1918	,, ,,
Leçons de Chirurgie de Guerre. Publiées sous la Direction de Cl. Rigaud		1918	Editor, Journal.
New South Wales. Report of the Director General of Public Health, New South Wales, for the year ended December 31, 1916		1918	,, ,,
Medical Research Committee. Reports of the Medical Investigation Committee:—			
No. 5—A Study of the Reaction of Pilots and Observers to diminished Oxygen Pressure		1918	Medical Research Committee.
No. 6—Respiratory Tests for Ability to Stand High Altitudes		1918	,, ,,
Reports of the Chemical Warfare Committee:—			
No. 14—The delayed Effects of Phosgene in Rabbits, with special reference to the Influence of Muscular Contraction		1918	,, ,,
No. 17—Report on Cases of Poisoning by "Mustard Gas" (Dichlorethyl Sulphide), with special reference to Histological Changes and to Alterations in the Leucocyte Counts		1918	,, ,,
No. 18—Report on the Medical Aspect of Mustard Gas		1919	,, ,,
Statistical Reports. No. 3—An Analysis of 8,670 Ophthalmic Cases treated in a Home Hospital		1919	,, ,,
National Health Insurance. Medical Research Committee. A Report on the Investigation of an Epidemic caused by *Bacillus aertrycke*		1919	,, ,,
Special Report Series No. 23—An Analysis of the Results of Wassermann Reactions in 1,435 Cases of Syphilis or suspected Syphilis		1919	,, ,,
Regulations of the Military Widows' Fund, British Service		1917	Commandant's Office.
Reports and Notes of the Public Health Laboratories, Cairo		1918	,, ,,
Pasteur Institute of India, Kasauli. Seventeenth Annual Report for the year ending December 31, 1917		1918	,, ,,

List of Books added to the Library—*Continued.*

Title of Work and Author	Edition	Date	How obtained
Medical Clinics of North America. United States Army Number. Vol. ii, No. 2		1918	War Office, A.M.D. 2.
War Neurosis and Military Training. By W. H. R. Rivers, M.D. Reprint, No 37		1918	,, ,,
Journal of the Royal Naval Medical Service. January ..		1919	The Editor.
Royal College of Physicians of London. Catalogue of the Library		1912	Librarian, Royal College of Physicians of London.
The Works of John Caius, M.D. With a Memoir of his Life. By John Venn, Sc.D.		1912	,, ,,
The Kitasato Archives of Experimental Medicine. Edited by S. Kitasato. Vol ii, Nos. 2 and 3		1918	Kitasato Institute for Infectious Diseases, Tokyo.
The Japan Medical Board. January 5 to February 9 ..		1919	Dr. S. Tsuchiya, Director.
Nigeria. Annual Medical and Sanitary Reports of the Northern and Southern Provinces for the year ending December 31, 1917		1918	The Director, Medical and Sanitary Service.
Woman's Hospital in the State of New York. Sixty-third Annual Report for the year ending September 30 ..		1918	The Secretary.
The Intensive Treatment of Syphilis and Locomotor Ataxia by Aachen Methods. By Reginald Hayes, M.R.C.S.	3rd	1919	Presented by the Author.
Description of the Serum Institute (Abbassia) and of the Preparation of Cattle Plague Serum. By Charles Todd, M.D.		1912	Presented by Major-General Sir D. Bruce, K.C.B.
List of the Fellows, Members, Extra-Licentiates and Licentiates, of the Royal College of Physicians of London		1918	,, ,,

EXCHANGES, &c.

The charge for inserting Notices respecting Exchanges in the Royal Army Medical Corps is 5/- for not more than five lines, which should be forwarded by Cheque or P.O.O., with the notice, to Messrs. G. STREET and CO., Ltd., 8, Serle Street, London, W.C., not later than the 22nd of the month.

A free issue of twenty-five reprints will be made to contributors of Original Communications, and of twenty-five excerpts of Lectures, Travels and Proceedings of the United Services Medical Society.

Any demand for reprints, additional to the above, or for excerpts, must be forwarded at the time of submission of the article for publication, and will be charged for at the following rates, and additional copies at proportionate rates:—

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	8	0 5 0	0 2 3	4 3	1 1	3 10	0 9
	16	0 8 3	0 3 11				
25	4	0 3 4	0 1 5				
	8	0 6 0	0 2 9	4 10	1 6	4 4	0 11
	16	0 10 6	0 5 0				
50	4	0 4 6	0 1 10				
	8	0 7 6	0 3 6	6 0	2 1	4 10	1 2
	16	0 13 3	0 5 10				
100	4	0 6 0	0 3 1				
	8	0 10 0	0 4 10	7 10	3 11	6 7	2 5
	16	0 18 6	0 7 6				
200	4	0 9 6	0 4 5				
	8	0 15 0	0 6 7	10 10	7 6	9 0	4 10
	16	1 6 0	0 9 8				

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Cases for Binding Volumes.—Strong and useful cases for binding can be obtained from the publishers at the undermentioned rates:—

Covers, 2s. 6d. net; binding, 2s. 6d.

These charges are exclusive of cost of postage.

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The above figures are subject to 25 per cent increase.

All Applications for Advertisements to be made to—

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Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are

inserted free of charge to subscribers and members of the Corps. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "Journal of the Royal Army Medical Corps," 324, Adastral House, Victoria Embankment, E.C. 4.

The following publications have been received:—

British: Edinburgh Medical Journal, The Medical Journal of Australia, Guy's Hospital Gazette, Public Health, Seale Hayne Neurological Studies, The Royal Engineers' Journal, The Hospital, The Medical Review, Annals of Tropical Medicine and Parasitology, Journal of the Royal United Service Institution, Reveille, Tropical Diseases Bulletin, The Medical Press, The Indian Medical Gazette, The Practitioner, Proceedings of the Royal Society of Medicine, Transactions and Seventh Annual Report of the London Dermatological Society, The Journal of Tropical Medicine and Hygiene, The Medical Journal of South Africa, The Journal of State Medicine, The Middlesex Hospital Journal, The Journal of the Royal Army Service Corps, The St. Thomas's Hospital Gazette, The Indian Journal of Medical Research, St. Bartholomew's Hospital Journal.

Foreign: Norsk Tidsskrift für Militaermedicin, Bulletin of the Johns Hopkins Hospital, Le Caducée, Bulletin de l'Institut Pasteur, The American Journal of Syphilis, Colonies et Marine, Surgery, Gynæcology and Obstetrics, Archives Medicales Belges, Bulletin de la Société de Pathologie Exotique, Giornale di Medicina Militare, War Medicine, Archives de Médecine et Pharmacie Navales, Abstract of Bacteriology, United States Department of Agriculture.

MANAGER'S NOTICES.

The Journal of the Royal Army Medical Corps is published monthly, six months constituting one volume, a volume commencing on 1st July and 1st January of each year.

The Annual Subscription is £1 (which includes postage), and should commence either on 1st July or 1st January; but if a subscriber wishes to commence at any other month he may do so by paying for the odd months between 1st July and 1st January at the rate of 1s. 8d. (one shilling and eightpence) per copy. (All subscriptions are payable in advance.)

Single copies can be obtained at the rate of 2s. per copy.

The Corps News is also issued separately from the Journal, and can be subscribed for at the rate of 2s. (two shillings) per annum, including postage. Subscriptions should commence from 1st July each year; but if intending subscribers wish to commence from any other month, they may do so by paying for the odd months at the rate of 2d. per copy. (All subscriptions are payable in advance.)

Officers of the Royal Army Medical Corps possessing Diplomas in Public Health, etc., are kindly requested to register their special qualifications at the War Office. Letters of complaint are frequently received from officers stating that their special qualifications have not been shown in the Distribution List which is published as a supplement to the Journal in April and October of each year. As, however, the particulars of this list are supplied from official sources, officers are reminded that unless the possession of Diplomas, etc., has been registered at the War Office, no entry of such qualifications can be recorded in the Distribution List.

Letters notifying change of address should be sent to the Hon. Manager, "Journal of the Royal Army Medical Corps," 25, Adastral House, Victoria Embankment, E.C. 4, and must reach there not later than the 20th of each month for the alteration to be made for the following month's issue.

It is requested that all Cheques or Postal Orders for Subscriptions to the Journal, Corps News, Reprints, etc., be crossed "Holt & Co.," and made payable to the "Hon. Manager, Journal R.A.M.C.," and not to any individual personally.

All communications for the Hon. Manager regarding subscriptions, etc., should be addressed to

The Hon. Manager,
"Journal of the Royal Army Medical Corps,"
25, Adastral House, Victoria Embankment, E.C.4.

ROYAL ARMY MEDICAL CORPS OFFICERS' BENEVOLENT SOCIETY.

PROCEEDINGS OF A COMMITTEE MEETING HELD AT ADASTRAL HOUSE, WAR OFFICE, ON APRIL 10, 1919.

Present.

Major-Gen. Sir M. W. Russell, K.C.M.G., C.B., one of the Vice-Presidents, in the Chair.
Major-Gen. Sir H. R. Whitehead, K.C.B.
Col. A. Peterkin, C.B.
Col. H. W. Murray.
Lieut.-Col. A. B. Cottell.
Capt. J. T. Clapham.

(1) The Minutes of the meeting held on January 23, 1919, were read and confirmed.

(2) The accounts for the year 1918, which have now been audited, were examined and approved.

(3) The draft report for the year 1918 was considered and adopted for presentation to the Annual General Meeting, which was fixed for June 11, at the Royal Army Medical College.

(4) Thirty applications for grants representing sixty orphans were considered and recommendations made for decision by the Annual General Meeting.

(5) It was suggested that in future copies of these applications should be sent to the members of the Committee some time before the meeting to allow of more detailed consideration of the merits of each case. The Secretary to take action accordingly.

(6) Recommendations for appointment to the Committee at the Annual General Meeting in accordance with Rule 13 were discussed.

(7) The Secretary reported donations as follows:—

	£	s.	d.
Major-Gen. M. H. G. Fell	150	0	0
Mrs. MacBean and Miss Allan	5	0	0
45th Indian General Hospital, Cairo	20	10	0
Lieut.-Col. G. B. Riddick	5	0	0
The D.D.M.S., Rouen .. .. 50 francs			
Rouen Medical Society..	10	7	8

(8) It was decided to recommend Lieut.-Col. E. M. Wilson to the Annual General Meeting for re-election as Secretary for one year from June 11, 1919.

ROYAL ARMY MEDICAL CORPS FUND.

PROCEEDINGS OF A COMMITTEE MEETING HELD AT WAR OFFICE, ADASTRAL HOUSE, ON APRIL 10, 1919.

Present.

Major-Gen. Sir M. W. Russell, K.C.M.G., C.B., in the Chair.
Major-Gen. Sir David Bruce, K.C.B.
Col. Sir James Magill, K.C.B.
Lieut.-Col. A. B. Cottell.
Major P. G. Easton, D.S.O.
Major E. P. Offord.
Capt. A. R. Wright, D.S.O., *Honorary Secretary of the Dinner Sub-Committee.*

(1) The Minutes of the last meeting held on January 23, 1919, were read and confirmed.

(2) The Accounts for 1918 were considered and approved, subject to the receipt of a clear certificate from the auditors regarding certain investments concerning which some information was still awaited from the Bank of England. The auditor's report to be submitted to the Chairman when received.

(3) The report of the Dinner Sub-Committee was received as follows:—

Proceedings of a meeting of the Sub-Committee for the Annual Dinner held on March 25, 1919.

Present.

Col. C. R. Tyrrell, C.B.
Col. J. R. McMunn, C.M.G.
Lieut.-Col. E. M. Wilson.
Lieut.-Col. F. S. Irvine, C.M.G., D.S.O.
Capt. A. R. Wright, D.S.O., *Honorary Secretary.*

(i) The Sub-Committee visited the following restaurants—

The Cafe Royal; Imperial; Criterion; and the Savoy,

and decided to recommend the acceptance of the offer of the Savoy, viz., £2 10s. per head, inclusive of wines, liqueurs, etc., but not cigars and cigarettes. Specimen menus to be submitted.

(ii) It was also recommended that cigars and cigarettes shall be purchased separately by arrangement with the Army and Navy Stores or other firms.

(iii) Recommended that the price of the Dinner tickets to subscribers should be 7s. 6d. as in former years, the balance being met by a grant from the Royal Army Medical Corps Fund, Officers Branch. Non-subscribers to pay the full amount of £2 10s.

(iv) Also that there shall be one principal table and that the others shall be tables of eight as in former years, thus permitting officers to make up their own parties.

(v) The date suggested was Wednesday, June 11, subject to the approval of H.R.H. the Duke of Connaught.

(vi) Recommended that a small string band be provided by the Depot and that the loan of Plate be requested from the different Messes, the cost being defrayed by the Royal Army Medical Corps Fund (Officers Branch).

(vii) It was recommended that the question of dress be submitted to H.R.H. the Honorary Colonel, as to whether it should be khaki uniform or evening dress with miniature decorations.

(viii) The question of remuneration to Mr. A. Dainty was discussed, and it was considered that it was not necessary to recommend an increase beyond the amount of £5 authorized in 1914.

(ix) Recommended that Mr. V. G. M. Holt be invited as Guest.

(4) The Report was adopted with the exception of the last sentence of paragraph 3 relating to non-subscribers, and the Secretary was instructed to ask the Director-General whether, in view of the great difficulty of obtaining accommodation for a large number in any public room, he considered it advisable to confine the Dinner solely to officers of the Royal Army Medical Corps Regular Army.

(5) The Committee approved the date, viz., June 11, having ascertained that this date is convenient to H.R.H. the Duke of Connaught, and recommended that the dress should be evening dress with miniature decorations, except that for officers on active service it should be optional to dine in khaki uniform.

(6) The date of the Annual General Meeting was fixed for Monday, June 11, at 2.30 p.m., at the Royal Army Medical College, Grosvenor Road.

(7) *Memorials Sub-Committee.*—The Secretary reported that the portrait of Lieut.-Gen. Sir Alfred Keogh, by Mr. A. Hacker, R.A., was completed, and was considered by the Sub-Committee to be exceedingly good. It will be on view at the Royal Academy next month. The Secretary was instructed to send Mr. Hacker a cheque accordingly. (2) The Memorial to certain officers specially distinguished in connexion with the unification of the Army Medical Services and the formation of the Royal Army Medical Corps has been somewhat delayed owing to the difficulty of obtaining a good portrait of one of the officers, but it is in progress, and it is hoped to have a complete report before the Annual General Meeting.

(8) The draft of the report for 1918 to be submitted to the Annual General Meeting was considered and approved.

(9) The Committee received the final report of a special grant under Rule 5 which had been authorized at the meeting held on October 15, 1918.

General Relief.

(10) Four grants already issued under Rule 9 amounting to £15 were approved, and five fresh applications under Rule 8 were considered, and the following grants approved:—

	£	s.	d.
Widow of Serjt. F. T. M.	6	0	0
Widow of Serjt. S. R.	3	0	0
Cpl. T. R. and family	5	0	0
Widow of Serjt. J. H. L. C.	3	0	0
Widow of Pte. H. S.	3	0	0
	£20	0	0

(11) The following donations were reported:—

	£	s.	d.
R.A.M.C., Guernsey	25	0	0
Serjeants' Mess, Aldershot	10	0	0
39th C.C.S., Italy	53	0	0
Major-Gen. M. H. G. Fell	150	0	0
No. 1 Coy., Aldershot	13	8	2
42nd Field Ambulance	15	6	6
33rd Stationary Hospital	27	11	0
Col. H. M. Sloggett	5	0	0
Six Officers	1	10	0
Rev. R. H. Hingley	10	0	0
R.A.M.C. Depot Football Match	10	0	0
	£320	15	8

(12) Acknowledgements and thanks were reported from the Sailors' and Soldiers' Help Society, the Corps of Commissionaires and the Incorporated Society for Employment of Discharged Soldiers, for annual subscriptions, and a special letter of thanks from the Union Jack Club for the subscription of £25 4s. and the additional donation of £25.

(13) The present cash balances of both branches were received, and it was decided to postpone the consideration of any further investments until the Annual General Meeting.

(14) Schools: Applications for assistance were considered from the Royal Drummond Institute at Dublin and the Home for Destitute Catholic Children, at both of which institutions orphans of the Corps are being educated, and it was decided to renew the subscriptions, viz., £12 to the former, and £10 to the latter.

(15) A small account was submitted by Capt. J. T. Clapham for "Press Cuttings" amounting to £2 8s. This had been authorized by the Committee Meeting held on April 17, 1918, and was passed for payment.

(16) Lieut.-Col. E. M. Wilson was recommended for re-election as Secretary for one year from June 11 next.

MINUTES OF A SPECIAL MEETING OF THE DINNER SUB-COMMITTEE HELD AT ADASTRAL HOUSE ON APRIL 22, 1919.

Present:

Lieut.-Gen. Sir T. H. J. C. Goodwin, K.C.B., C.M.G., D.S.O., K.H.S., Director-General.
Major-Gen. Sir David Bruce, K.C.B.
Col. C. R. Tyrrell, C.B.
Col. J. R. McMunn, C.M.G.
Col. Sir J. R. A. Clark, C.B., C.M.G.
Col. S. F. Clark, representing Woolwich.
Lieut.-Col. F. S. Irvine, C.M.G., D.S.O., representing Aldershot.
Major M. Sinclair, C.M.G., representing Netley.
Lieut.-Col. E. M. Wilson.
Capt. A. R. Wright, D.S.O., Honorary Secretary.

(1) The question as to whether officers of the Special Reserve, Royal Army Medical Corps, the Royal Army Medical Corps (Territorial), and those serving or who have served during the present war with temporary commissions should be allowed to attend as non-subscribers on payment of the full price of the dinner was thoroughly discussed, and it was eventually proposed by Col. C. R. Tyrrell, and seconded by Lieut.-Col. F. S. Irvine, that regular subscribers to the Corps Fund shall come first, but that officers belonging to the other branches of the Royal Army Medical Corps shall be invited for this occasion only, as guests; secondly, that the number of guests shall not exceed the number of members dining: thirdly, that the accommodation at the Hotel shall not be exceeded; fourthly, that the selection of guests shall be decided by a sub-committee. This was carried unanimously.

(2) Proposed by Lieut.-Col. F. S. Irvine and seconded by Major M. Sinclair, that the sub-committee shall consist of Lieut.-Gen. Sir T. H. J. C. Goodwin, Col. Sir E. Worthington, Col. C. R. Tyrrell, Lieut.-Col. E. M. Wilson, Capt. A. R. Wright, Honorary Secretary. Carried.

(3) Proposed by Col. S. F. Clark and seconded by Col. J. R. McMunn, that the cost of the guests' dinners shall be a charge on the Royal Army Medical Corps Fund, Officers' Branch. Carried.

(4) Proposed by Col. J. R. McMunn and seconded by Lieut.-Col. F. S. Irvine, that subject to the wishes of the Duke of Connaught there shall be no speeches beyond the usual loyal toasts.

(5) That notices shall be sent to members and guests that the dress shall be uniform, khaki or blue serge, or evening dress with miniature decorations.

JOURNAL
OF THE
ROYAL ARMY MEDICAL CORPS.

Corps News.

May, 1919.

EXTRACTS FROM THE "LONDON GAZETTE."

Central Chancery of the Orders of Knighthood.

St. James's Palace,
March 15, 1919.

The King has been graciously pleased to give orders for the following appointment to the Most Excellent Order of the British Empire, for valuable services rendered during the War in Military Record Offices in the United Kingdom (the appointment to date from January 1, 1919):—

To be a Member of the Military Division of the said Most Excellent Order:—

Temp. Qmr. and Capt. William Tuson, Royal Army Medical Corps.

His Majesty the King has been graciously pleased to approve of the award of the Meritorious Service Medal to the undermentioned Warrant Officers in recognition of valuable services rendered in connexion with the war in Record Offices:—

Home.

18833 Cpl. (Acting Warrant Officer Class II, Staff Qmr.-Serjt.) R. Crook, Royal Army Medical Corps (Winchester).

5906 Serjt. (Acting Warrant Officer Class I) C. G. Fagg, Royal Army Medical Corps (Great Yarmouth).

St. James's Palace, S.W.
March 22, 1919.

The King has been graciously pleased to give orders for the following appointments to and promotion in the Most Excellent Order of the British Empire for valuable services rendered in connexion with Military Operations in France and Flanders. The appointments and promotion to date from January 1, 1919:—

To be Commanders of the Military Division of the said Most Excellent Order:—

Temp. Lieut.-Col. Arthur Albert Messer, Gen. List.

Lieut.-Col. (Temp. Col.) Alfred Bertram Soltau, C.M.G., O.B.E., Royal Army Medical Corps (Territorial Force). (Substituted for the notice which appeared on p. 10 of the *London Gazette* dated January 1, 1919.).

To be a Member of the Military Division of the said Most Excellent Order:—

Temp. Capt. and Qmr. Edward Allsop Beattie, Royal Army Medical Corps.

War Office,
March 22, 1919.

His Majesty the King has been graciously pleased to approve of the undermentioned award for distinguished service in connexion with military operations in the field. Dated January 1, 1919:—

To be Brevet-Major:—

Capt. J. Scott, D.S.O., M.B., Indian Medical Service.

His Majesty the King has been graciously pleased to approve of the undermentioned awards for valuable services rendered in connexion with the war. Dated January 1, 1919:—

To be Brevet-Major:—

Capt. C. W. Wirgman, M.D., F.R.C.S., Royal Army Medical Corps (Territorial Force).

To be granted the next higher rate of pay under the provision of the Royal Warrant:—

Qmr. and Capt. E. W. Newland, Royal Army Medical Corps.

AMENDMENTS TO SUPPLEMENT TO *London Gazette*, DATED JANUARY 1, 1919.

Page 52: For Lieut.-Col. (Temp. Brig.-Gen.) Charles Snodgrass Ryan, A.A.M.C., read Temp. Col. (Hon. Surg.-Gen.) Charles Snodgrass Ryan, C.B., V.D., A.A.M.C.

Page 39: For 538144 Pte. (Acting Cpl.) W. Fowler, 6th (London) Field Ambulance, Royal Army Medical Corps (Territorial Force), attached 1/21st Field Ambulance, read 538144 Pte. (Acting Cpl.) W. Fowler, 6th (London) Field Ambulance, Royal Army Medical Corps (Territorial Force), attached 21st Battalion, London Regiment.

War Office,
March 25, 1919.

The names of the undermentioned have been brought to the notice of the Secretary of State for War for valuable services rendered in connexion with the War, and when applicable an entry will be made in the records of service of officers and other ranks :—

Department of the Chief of the Imperial General Staff.

Major A. M. H. Gray, Royal Army Medical Corps (Territorial Force).

Department of the Adjutant General to the Forces.

ROYAL ARMY MEDICAL CORPS.

Temp. Capt. J. S. Arthur.
Temp. Capt. A. E. Atkinson.
Major A. Bird.
Temp. Capt. E. P. Cathcart.
Major P. G. Easton.
Temp. Capt. W. W. Halstead.
Temp. Lieut.-Col. F. R. Hill.
Temp. Capt. W. G. Hopkins.
Capt. J. G. E. Hosken (Territorial Force).
Col. J. R. McMunn, Army Medical Service.
Qmr. and Capt. E. P. Moss.
Temp. Capt. A. J. A. Peters.
Capt. (Acting Major) B. Shires (Special Reserve).
Major A. B. Smallman.
Capt. H. W. Spaight (Territorial Force).
Temp. Lieut.-Col. Sir H. J. Stiles.
Temp. Lieut.-Col. P. C. E. Tribe.
Temp. Capt. E. U. Williams.
Temp. Major S. W. Williams.
Temp. Capt. E. D. Wortley.
113360 Pte. (Acting Cpl.) A. G. Allen.
73123 Pte. (Acting Staff-Serjt.) E. Burrows.
29691 Staff-Serjt. S. A. Clarke.
316415 Pte. (Acting Cpl.) A. Currie.
51825 Pte. W. Fairclough.
8770 Serjt.-Major J. Crossman.
104133 Serjt. J. Hill.
11258 Serjt.-Major T. Leggett.
15783 Staff-Serjt. (Acting Serjt.-Major) E. F. H. Lloyd.
11783 Serjt.-Major D. Macdonald.
83282 Pte. (Acting Cpl.) R. W. A. MacDonald.
4962 Qmr.-Serjt. J. Matheson.
4942 Serjt. A. McCombie.
10992 Serjt. W. Murray.
29512 Staff-Serjt. J. Phelps.
15079 Serjt. W. Rowson.
104547 Staff-Serjt. C. R. Sturgis.

Lieut.-Col. H. A. Smith, Indian Medical Service.

War Office,
March 27, 1919.

The names of the undermentioned have been brought to the notice of the Secretary of State for War for valuable services rendered in connexion with the war, and, when applicable, an entry will be made in the records of service of officers and other ranks :—

ROYAL ARMY MEDICAL CORPS.

Temp. Capt. J. H. Addinsell.
Temp. Capt. G. W. Ancrum, M.B.
Major A. W. Anderson, T.D., M.D.
Major R. Y. Anderson, M.B., 312th Field Ambulance.
Major G. Ashton, M.D., 2nd E. Lancs. Field Ambulance (T.F.).
Major (Acting Lieut.-Col.) J. E. Bates, T.D., M.B. (T.F.).
Temp. Lieut. H. M. Berry, M.D.
Temp. Lieut.-Col. J. J. G. Blandford.
Major R. Brodie, T.D. (T.F.).
Temp. Capt. A. D. Buchanan, M.B.
Temp. Capt. A. H. G. Burton, M.D.
Capt. W. D. Carruthers, M.D. (T.F.).
Major (Acting Lieut.-Col.) J. E. Carter, M.B. (Reserve of Officers).
Temp. Hon. Lieut.-Col. H. Chaffer, F.R.C.S.
Temp. Capt. G. B. Courtney, M.D.
Temp. Capt. (Acting Major) C. C. de B. Daly, M.B.
Capt. W. C. Davidson, M.B. (Special Reserve).
Capt. H. S. Dickson.
Temp. Capt. W. J. Dilling, M.B.
Temp. Capt. A. C. Dixon.
Temp. Capt. (Acting Major) J. P. Duncan, M.B.
Temp. Capt. J. S. Dunn, M.D.
Major A. F. Fergus, M.D. (T.F.) (Retired).
Temp. Capt. (Acting Major) G. W. FitzHenry.
Temp. Major R. T. Heron.
Temp. Capt. A. F. Hewat, M.B., F.R.C.P.Edin.
Qmr. and Major J. Hirst.
Major J. W. B. Hodson (T.F.).
Major J. Howard Jones, T.D., M.D., 321st (Welsh) Field Ambulance.
Temp. Capt. R. B. Hunt.
Temp. Major R. J. D'A. Irvine.
Major J. K. Jamieson, M.B.
Temp. Lieut.-Col. J. Keay, M.D., F.R.C.P.
Lieut.-Col. G. S. Mansfield, M.B. (Reserve of Officers).
Temp. Capt. J. A. Matson, M.D., F.R.C.P.I.
Major J. B. MacBride (T.F.).

Temp. Capt. (Acting Major) J. T. McCullagh, M.B.
Temp. Capt. F. E. McGee.
Lieut.-Col. (Acting Col.) A. M. McIntosh, T.D., M.B., F.R.C.S.Edin. (T.F.).
Major G. W. McIntosh, M.B. (T.F. Reserve).
Major J. P. Milne, 320th (North'bn) Field Ambulance (T.F.).
Lieut.-Col. R. Muir, M.D. (T.F.).
Lieut.-Col. P. S. O'Reilly, C.M.G.
Lieut.-Col. F. J. Paley, M.D. (T.F.).
Temp. Major W. Pearson, M.D., F.R.C.S.I.
Temp. Capt. A. C. Pickett.
Major S. W. Plummer, M.D. (T.F.).
Temp. Lieut.-Col. L. W. Pockett, T.D., M.D., 329th (Lowland) Field Ambulance (T.F.).
Lieut.-Col. E. Quayle, Lan. (Vol.).
Lieut.-Col. A. de C. Scanlan, C.M.G.
Temp. Qmr. and Lieut. E. T. Smith.
Temp. Capt. J. S. K. Smith, F.R.C.S.
Temp. Capt. H. Smurthwaite, M.D.
Capt. H. W. Spaight (T.F.).
Capt. (Acting Major) H. B. Sproat, M.D. (T.F.)
Major A. Stables, M.B. (R.P.).
Capt. H. V. Stanley, M.C., M.B.
Lieut.-Col. R. Stockman, M.D. (T.F.).
Lieut.-Col. J. Tidbury, M.D. (R.P.).
Qmr. and Capt. S. H. Ware (T.F.).
Temp. Capt. (Acting Lieut.-Col.) C. J. West, M.D.
Major G. H. G. Whiteford, T.D., M.B. (T.F.).
Temp. Capt. (Acting Major) A. W. G. Woodford, M.B.
Temp. Capt. G. F. Woodroffe.
61688 Pte. (Acting Qmr.-Serjt.) J. M. Aitken.
500006 Qmr.-Serjt. (Temp. Serjt.-Major) R. H. Ballard (T.F.).
25387 Qmr.-Serjt. J. E. Barker.
17257 Staff-Serjt. (Acting Qmr.-Serjt.) J. J. Bartleet.
455055 Pte. F. T. Beasant (T.F.).
25547 Serjt. G. G. Bees.
10568 Pte. (Acting Serjt.-Major) G. Bennett.
50274 Cpl. (Acting Serjt.) A. W. C. Bowes.
31203 Pte. W. M. Bristow.
9631 Serjt. (Acting Staff-Serjt.) J. Browning.
104179 Cpl. (Acting Serjt.) A. R. Burton.
9713 Qmr.-Serjt. J. D. Carlile.
10400 Temp. Serjt.-Major T. F. Catley.
35471 Staff-Serjt. (Acting Qmr.-Serjt.) J. C. Chesterman.
8699 Serjt. (Acting Staff-Serjt.) W. G. Chettleburgh, 20th Company.
333039 Pte. (Acting Serjt.) H. Cornwall (T.F.).
27359 Qmr.-Serjt. R. H. Crosse.
23775 Serjt.-Major G. R. Curry, 8th Company.
25796 Qmr.-Serjt. A. Curtis.
104318 Pte. (Acting Serjt.) A. W. J. Denney.
184 Staff-Serjt. (Acting Qmr.-Serjt.) I. B. Dodd.
79002 Cpl. (Acting Qmr.-Serjt.) G. E. Easley.
67731 Serjt. (Acting Qmr.-Serjt.) A. Fallon, 319th Field Ambulance.
16524 Qmr.-Serjt. (Temp. Serjt.-Major) H. Fandam.
104925 Cpl. (Acting Staff Serjt.) H. V. Garnham.
99018 Pte. (Acting Serjt.) P. George, 312th Field Ambulance, now 7th Battalion, Training Reserve.
67670 Serjt. (Acting Serjt.-Major) E. J. Gibson.
28923 Staff-Serjt. (Acting Serjt.-Major) F. Goodenough.
28979 Cpl. (Acting Staff-Serjt.) R. Gray.
26969 Cpl. W. Greedy.
27296 Staff-Serjt. G. Grocott.
100830 Cpl. (Acting Serjt.) J. Hurley.
27848 Serjt. T. Jackson.
67782 Pte. (Acting Cpl.) E. C. Jakeman, 322nd Field Ambulance.
330016 Staff-Serjt. E. Kelly (T.F.).
104441 Pte. (Acting Qmr.-Serjt.) W. Kershaw.
33025 Pte. (Acting Serjt.) J. Kirkpatrick (T.F.).
66765 Pte. (Acting Serjt.) G. W. Lambourne, 20th Coy.
26050 Staff-Serjt. (Acting Qmr.-Serjt.) J. Lisle.
545400 Pte. (Acting Serjt.) W. Pepper (T.F.).
500191 Cpl. (Acting Serjt.-Major) S. Pinkney (T.F.).
29013 Serjt. (Acting Qmr.-Serjt.) S. G. Rhodes.
28939 Staff-Serjt. A. E. Richards.
56999 Pte. (Acting Cpl.) E. Robinson.
11582 Serj.-Major J. Ryan.
100273 Pte. (Acting Cpl.) W. H. Sherwood.
457188 Serjt. (Acting Serjt.-Major) W. L. Shorland (T.F.).
26196 Staff-Serjt. E. Stevens.
28834 Temp. Serjt.-Major W. H. Terry.
26354 Serjt. J. W. Thornley.
25952 Serjt.-Major E. E. Wallis.
105317 Serjt.-Major A. Wheeldon.
28675 Staff-Serjt. H. T. Williams.
18230 Staff-Serjt. (Acting Serjt.-Major) F. Winkley, 6th Coy.
106151 Cpl. (Acting Serjt.) H. Wise.
67768 Serjt. (Acting Staff-Serjt.) H. W. Woffinden.
17727 Staff-Serjt. (Acting Serjt.-Major) A. Wrigley.
12999 Pte. J. Yerrill.

Dominion of Canada.

Canadian Army Medical Corps.

Lieut.-Col. F. C. Bell.
Major F. S. Burke.
Lieut.-Col. C. E. C. Cole.
Col. G. C. Farmer, C.B.E.
Lieut.-Col. W. J. O. Malloch.
Lieut.-Col. E. G. Mason.
Lieut.-Col. J. C. Meakins.
Major W. F. Nicholson, M.C.
Capt. P. D. Saylor.
Lieut.-Col. E. L. Stone.
Capt. (Acting Major) J. J. Thomson.
535549 Pte. (Acting Staff-Serjt.) E. D. Campbell.
33235 Serjt. (Acting Serjt.-Major) C. Francis.
17089 Serjt. (Acting Staff-Serjt.) B. W. Frost.
912 Qmr. (Acting Serjt.-Major) G. Hamilton.
1000444 Pte. (Acting Serjt.) G. E. Rae.
622223 Pte. (Acting Serjt.) H. Stevenson.
501083 Serjt.-Major H. Sweeney, 10th General Hospital.
524736 Pte. (Acting Serjt.) M. Wallace.
114067 Pte. (Acting Staff-Serjt.) C. H. Whitham.

Commonwealth of Australia.

Australian Army Medical Corps.

Capt. H. R. Arnold.
Major A. Cook.
Capt. G. Finlay.
Major J. P. Fogarty, M.C.
Major N. M. Gibson.
Major H. A. C. Irving.
Major M. C. C. Seton.
Capt. E. B. Thomas.
10152 Pte. E. J. Ambrose, attached 2nd Auxiliary Hospital.
8690 Pte. E. Andrews, attached 1st Auxiliary Hospital.
3557 Pte. J. S. Armstrong, 3rd Auxiliary Hospital.
38 Staff-Serjt. A. C. Austin, 2nd Field Ambulance.
1117 Warrant Officer H. M. Blackham.
9122 Serjt. C. A. R. Board.
483 Serjt. A. W. Brierley, 3rd Field Ambulance.
3036 Lance-Cpl. (Temp. Cpl.) V. W. Bull, 2nd Auxiliary Hospital.
106 Cpl. (Temp. Serjt.) A. T. Cornish, 2nd Auxiliary Hospital.
12601 Serjt. (Temp. Staff-Serjt.) W. S. Crawford, attached 1st Auxiliary Hospital.
1808 Pte. (Temp. Cpl.) L. W. Dawson, 1st Auxiliary Hospital.
1910 Pte. E. A. Few, attached 1st Auxiliary Hospital.
3753 Cpl. (Temp. Serjt.) J. R. Fitzpatrick.
13291 Pte. F. G. Goddard, 3rd Auxiliary Hospital.
9538 Staff-Serjt. L. R. M. Gray, 1st General Hospital.
1229 Pte. (Temp. Regt. Qmr.-Serjt.) S. Hadlow.
20 Serjt. W. G. Hardess, 2nd Field Ambulance.
2693 Cpl. J. A. C. Kemp, Dental Service.
7638 Warrant Officer W. Leeming.
2639 Staff Qmr.-Serjt. H. Lister, 4th Light Horse Field Ambulance.
1154 Staff-Serjt. C. Marques, 3rd Auxiliary Hospital.
2812 Serjt. A. R. Milton, 5th Field Ambulance.
1006 Pte. (Temp. Cpl.) E. S. Munday, Dental Service.
15565 Pte. (Temp. Serjt.) H. G. Penrose.
9588 Cpl. C. E. P. Rowe, 3rd Auxiliary Hospital.
6476 Staff-Serjt. T. A. Stoddart.
9212 Serjt. R. D. Toppin, attached 1st Auxiliary Hospital.
162 Pte. (Temp. Cpl.) L. V. Tyzack.
5031 Staff-Serjt. H. G. Wonders, 5th Field Ambulance.

Dominion of New Zealand.

New Zealand Medical Corps.

Major T. Fergus.
Major A. Hosking.
Capt. T. Julian.
Capt. E. C. Lowe.
Major (Temp. Lieut.-Col.) V. M. Macdonald.
Capt. W. C. McCaw.
Capt. D. F. Myers.
Capt. A. J. Orchard.
Major J. C. Simpson.
Capt. W. H. Simpson.
Capt. A. H. Tovey.

March 29, 1919.

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Military Medal to the undermentioned Non-commissioned Officers and Men :—

Bar to Military Medal.

8307 Pte. J. Lee, M.M., 22nd Field Ambulance, Royal Army Medical Corps (Mansfield). (Italy.) (M.M. gazetted November 11, 1916.)

1998 Pte. E. Patrick, D.C.M., M.M., 22nd Field Ambulance, Royal Army Medical Corps (Leeds). (Italy.) (M.M. gazetted December 9, 1916.)

8671 Cpl. (Acting Serjt.) T. Mooney, M.M., 71st Field Ambulance, Royal Army Medical Corps (Liverpool). (Italy.) (M.M. gazetted December 12, 1917.)

1335 Cpl. A. J. Loughton, M.M., 4th Field Ambulance, Canadian Army Medical Corps. (M.M. gazetted January 24, 1919.)

His Majesty the King has been graciously pleased to approve of the award of the Military Medal for Bravery in the Field to the undermentioned Non-commissioned Officers and Men :—

Royal Army Medical Corps.

67948 Serjt. E. E. Hunt, 70th Field Ambulance (Gorleston-on-Sea). (Italy.)
34496 Serjt. H. C. Trueman, 71st Field Ambulance (Whitley Bay). (Italy.)
437548 Serjt. (Acting Staff-Serjt.) A. E. Wilson, 2nd Field Ambulance (Gloucester). (Italy.)
435586 Serjt. A. W. J. Wyatt, 3rd Field Ambulance (Oxford). (Italy.)
18219 Cpl. (Acting Serjt.) D. J. Robertson, 22nd Field Ambulance (Leith). (Italy.)
459261 Cpl. W. J. Rothero, Royal Army Medical Corps (Camborne).
24009 Cpl. L. M. Steer, 22nd Field Ambulance (Exeter). (Italy).
75623 Pte. B. Akitt, 21st Field Ambulance (Leeds). (Italy.)
2222 Pte. (Acting Cpl.) W. H. Baker, 3rd Field Ambulance (Doddiscombskigh). (Italy).
38530 Pte. W. Bowden, 37th Field Ambulance (Hetton-le-Hole).
437046 Pte. S. Brown, 1/2nd Field Ambulance (Birmingham). (Italy.)

20654 Pte. J. Cassell, 22nd Field Ambulance (St. Helens). (Italy.)
37609 Pte. F. Crosland, 23rd Field Ambulanee (Oldham). (Italy.)
345194 Pte. G. Davis, 1st Field Ambulance (Tamworth). (Italy.)
341482 Pte. T. Devanney, 2nd Field Ambulance (St. Helens). (Italy.)
77032 Pte. W. Fairclough, 69th Field Ambulance (Burnley). (Italy.)
117366 Pte. J. Finch, 5th Field Ambulance (Wigan).
437239 Pte. H. Hone, 2nd Field Ambulance (Birmingham). (Italy.)
32267 Pte. J. Messon, 69th Field Ambulance (Sheffield). (Italy.)
36073 Pte. E. J. Neale, 69th Field Ambulance (Bow). (Italy.)
39834 Pte. S. C. Park, 21st Field Ambulance (Bury). (Italy.)
43716 Pte. C. E. Ross, 21st Field Ambulance (Paisley). (Italy.)
10715 Pte. W. H. Rouget, 22nd Field Ambulance (Guernsey). (Italy.
37754 Pte. W. H. Thompson, 21st Field Ambulance (Kendal). (Italy.)
8103 Pte. T. S. Turley, 23rd Field Ambulance (Dunston-on-Tyne). (Italy.)
439032 Pte. A. Vick, 1/3rd Field Ambulance (Bristol). (Italy.)

Decorations conferred by His Majesty the King of the Belgians.

Ordre de Leopold II.

Chevalier.

18432 Qmr.-Serjt. (Temp. Serjt.-Major) George Frederick Pearce, Royal Army Medical Corps (E. Leeds).

Decoration Militaire 2nd Class.

Royal Army Medical Corps.

70609 Pte. Ernest Bell (Gateshead).
79983 Pte. William Birnie (Rather).
82002 Pte. William John Green (Bedford).
92309 Pte. (Acting Cpl.) Archibald McArthur (Partick, Glasgow).
53946 Pte. Joseph A. Mooney (Cork).
49058 Pte. Hamilton Relly Taffs (Wandsworth Common, S.W.).

South African Medical Corps.

1385 Cpl. Charles James Joseph.
1123 Serjt. Edward Fredk. Martin (Kaschula).
988 Serjt. Edmund Bloomfield Kekewich.
1398 Serjt. Donald MacFarquhar.
2245 Pte. Frederick George Odendal.
295 Staff-Serjt. Charles Richard Tee.

War Office,
April 2, 1919.

His Majesty the King has been graciously pleased to approve of the following awards to the undermentioned Officers in recognition of their gallantry and devotion to duty in the Field. The acts of gallantry for which the decorations have been awarded will be announced in the *London Gazette* as early as possible.

Awarded the Distinguished Service Order.

Capt. (Acting Major) William Barnsley Allen, V.C., M.C., M.B., Royal Army Medical Corps, attached 1/3rd (West Riding) Field Ambulance, Royal Army Medical Corps, Territorial Force.

Major Archibald Craig Amy, M.D., Royal Army Medical Corps, attached 2/1st (Highlanders) Field Ambulance, Royal Army Medical Corps, Territorial Force.

Temp. Capt. (Acting Major) Ronald Campbell Cooke, M.C., 134th Field Ambulance, Royal Army Medical Corps.

Temp. Capt. John Hay Moir, M.C., M.D., Royal Army Medical Corps, attached 17th Battalion, Royal Fusiliers.

Canadian Force.

Major John Freeman Blair, Canadian Army Dental Corps, attached 4th Field Ambulance, Canadian Army Medical Corps.

Major Burnet Elmer Kelly, 9th Field Ambulance, Canadian Army Medical Corps.

Major George Willard Treleaven, M.C., 4th Field Ambulance, Canadian Army Medical Corps.

Awarded a Second Bar to the Military Cross.

Capt. Robert Bell Stewart, M.C., M.B., Royal Army Medical Corps, Special Reserve, attached 55th Field Ambulance, Royal Army Medical Corps. (M.C. gazetted January 14th, 1st Bar awarded January 18, 1918.)

Awarded a Bar to the Military Cross.

Capt. (Acting Major) Joseph Herbert Bayley, M.C., Royal Army Medical Corps, Special Reserve, attached 76th Field Ambulance. (M.C. gazetted June 4, 1918.)

Temp. Capt. Eric Biddle, M.C., 91st Field Ambulance, Royal Army Medical Corps, (M.C. gazetted June 18, 1917.)

Capt. (Acting Major) Thomas William Clarke, M.C., M.B., Royal Army Medical Corps (Special Reserve), attached 148th Field Ambulance. (M.C. gazetted March 27, 1915.)

Capt. (Acting Major) Henry Norman Goode, M.C., M.B., 1/1st (West Riding) Field Ambulance, Royal Army Medical Corps (Territorial Force). (M.C. gazetted September 16, 1918.)

Temp. Capt. (Acting Major) Charles Hope Haddow, M.C., M.B., 77th Field Ambulance Royal Army Medical Corps. (M.C. gazetted September 16, 1918.)

Capt. (Acting Major) Clark Nicholson, M.C., M.B., Royal Army Medical Corps (Special Reserve), attached 42nd Field Ambulance. (M.C. gazetted January 1, 1919.)

Temp. Lieut. Thomas Gordon Playford, M.C., M.D., Royal Army Medical Corps, attached 1/1st (Northumberland) Field Ambulance, Royal Army Medical Corps (Territorial Force). (M.C. gazetted September 24, 1918.)

Temp. Capt. (Acting Major) Arthur Richmond, M.C., M.B., 19th Field Ambulance, Royal Army Medical Corps. (M.C. gazetted January 1, 1917.)

Capt. (Acting Major) Arthur Leonard Shearwood, M.C., M.B., Royal Army Medical Corps (Special Reserve), attached 33rd Field Ambulance. (M.C. gazetted February 15, 1919.

Capt. (Acting Major) Hubert Shield, M.C., M.B., 1/st (Northumberland) Field Ambulance, Royal Army Medical Corps (Territorial Force). (M.C. gazetted July 26, 1918.)

Capt. (Acting Major) Robert Alexander Stark, M.C., M.B., 1/3rd (West Riding) Field Ambulance, Royal Army Medical Corps (Territorial Force). (M.C. gazetted September 26, 1917.)

Temp. Capt (Acting Major) Ivan Stuart Wilson, M.C., M.D., 9th Field Ambulance, Royal Army Medical Corps. (M.C. gazetted January 1, 1917.)

Canadian Force.

Capt. George Alexander Smith, M.C., 13th Field Ambulance, Canadian Army Medical Corps. (M.C. gazetted February 16, 1919.)

Capt. Richard Chapman Weldon, M.C., Canadian Army Medical Corps, attached 2nd Mounted Brigade, Canadian Machine Gun Corps. (M.C. gazetted February 15, 1919.)

AWARDED THE MILITARY CROSS.

Capt. (Acting Major) George Frederick Allison, Royal Army Medical Corps, attached 149th Field Ambulance.

Temp. Capt. Lewis Anderson, M.B., D.S.O., Royal Army Medical Corps (D.A.D.M.S., 32nd Division).

Lieut. Edgar Richard Batho, Royal Army Medical Corps (Special Reserve), attached 16th Battalion Lancashire Fusiliers.

Temp. Lieut. Andrew Fisher Calwell, M.B., Royal Army Medical Corps, attached 13th Battalion King's Royal Rifle Corps.

Temp. Hon. Capt. Donald Earl Carter, Royal Army Medical Corps, attached 13th Battalion East Lancashire Regiment.

Capt. Raymond John Chapman, M.D., 2/3rd (East Lancashire) Field Ambulance, Royal Army Medical Corps (Territorial Force.)

Capt. Douglas Gordon Cheyne, M.D., Royal Army Medical Corps, attached 240th (S.M.) Brigade Royal Field Artillery (Territorial Force).

Temp. Capt. Herbert Midgley Cockroft, Royal Army Medical Corps, attached 75th Brigade Royal Field Artillery.

Temp. Capt. Archibald Francis Reignier Conder, M.D., 109th Field Ambulance, Royal Army Medical Corps.

Capt. Walter Mundy Cox, 1/2nd (S.M.) Field Ambulance, Royal Army Medical Corps, (Territorial Force). (Italy.)

Capt. John James Balmarno Edmund, M.B., Royal Army Medical Corps (Special Reserve), attached 4th Battalion King's Royal Rifle Corps.

Temp. Capt. Dugald Ferguson, M.B., Royal Army Medical Corps, attached 168th Brigade Royal Field Artillery.

Capt. (Acting Major) Thomas Ottiwell Graham, M.D., Royal Army Medical Corps (Special Reserve) attached 71st Field Ambulance. (Italy.)

Temp. Capt. Hugh Arrowsmith Grierson, M.D., Royal Army Medical Corps, attached 251st (Northumberland) Brigade Royal Field Artillery (Territorial Force).

Temp. Hon. Capt. Edward Harding, Royal Army Medical Corps, attached 4th Battalion King's Royal Rifle Corps.

Capt. James Gill Hill, 2/2nd (Northumberland) Field Ambulance, Royal Army Medical Corps (Territorial Force).

Temp. Capt. Trevor Howell, Royal Army Medical Corps, attached 246th (West Riding) Brigade Royal Field Artillery (Territorial Force).

Capt. George Gerald Jack, Royal Army Medical Corps (Special Reserve), attached 2/2nd (West Riding) Field Ambulance, Royal Army Medical Corps (Territorial Force).

Temp. Capt. Rupert William Percival Jackson, 91st Field Ambulance, Royal Army Medical Corps.

Temp. Capt. Arthur Cecil Laing, M.B., Royal Army Medical Corps, attached 1/2nd (High.) Field Ambulance, Royal Army Medical Corps (Territorial Force).

Temp. Capt. Frank Whitwell Kinnear Lawrie, M.B., Royal Army Medical Corps, attached 11th Battalion Notts and Derby Regiment.

Temp. Capt. Percival Garmany Leeman, M.B., 12th Field Ambulance, Royal Army Medical Corps.

Capt. (Acting Major) Henry Wingate Maltby, Royal Army Medical Corps (Special Reserve), attached 22nd Field Ambulance. (Italy.)

Temp. Capt. David Lyall Morrison, M.D., Royal Army Medical Corps, attached 27th Brigade Royal Field Artillery.

Lieut. Malcolm Clark Paterson, M.B., Royal Army Medical Corps (Special Reserve), attached 7th Battalion Seaforth Highlanders.

Lieut. Arthur Vernon Pegge, Royal Army Medical Corps (Special Reserve). attached 15th Battalion Lancashire Fusiliers. (Mesopotamia).

Capt. (Acting Major) Andrew Picken, M.B., Royal Army Medical Corps (Special Reserve), attached 70th Field Ambulance. (Italy.)

Temp. Capt. Alfred James Pirie, M.B., Royal Army Medical Corps, attached 10th Battalion Essex Kegiment.

Capt. (Acting Major) Richard Payne Pollard, 2/3rd (London) Field Ambulance, Royal Army Medical Corps.

Capt. (Acting Major) Herbert Barrett Pope, 2/1st (West Riding) Field Ambulance, Royal Army Medical Corps (Territorial Force).

Capt. Stuart Robertson, M.B., Royal Army Medical Corps (Territorial Force), attached 16th Battalion R.W. Fusiliers.

Capt. (Acting Major) William Albert Robertson, 2/2nd (Northumberland) Field Ambulance, Royal Army Medical Corps (Territorial Force).

Capt. (Acting Major) Henry James Drew Smythe, 1/3rd (S.M.) Field Ambulance, Royal Army Medical Corps (Territorial Force). (Italy).

Temp. Capt. Thomas Stordy, 23rd Field Ambulance, Royal Army Medical Corps. (Italy.)

Canadian Force.

Capt. Walter Corneil Morgan, Canadian Army Medical Corps, attached 46th Battalion Sask Regiment.

Capt. George Armand Pare, 11th Field Ambulance, Canadian Army Medical Corps.

Australian Imperial Force.

Capt. Harris Mendelsohn, 6th Field Ambulance, Australian Army Medical Corps, attached 21st Battalion Australian Infantry.

War Office,
April 5, 1919.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for distinguished services rendered during the course of the campaign:—

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

DECORATIONS AND MEDALS CONFERRED BY HIS MAJESTY THE KING OF THE BELGIANS.

Décoration Militaire.

3657 Pte. Andrew Graham, M.M., Royal Army Medical Corps, attached 122nd Battery, Royal Field Artillery (Lanark).

41307 Pte. Robert Spence Greenfield, M.M., 108th Field Ambulance, Royal Army Medical Corps (Lisburn).

53722 Pte. George Lauder McAusland, M.M., 73rd Field Ambulance, Royal Army Medical Corps (Paisley).

CANADIAN FORCE.

Croix de Guerre.

1241 Pte. Arthur James Collicutt, 4th Canadian Field Ambulance, Canadian Army Medical Corps.

529553 Pte. James Walter Dow, 10th Canadian Field Ambulance, Canadian Army Medical Corps.

AUSTRALIAN IMPERIAL FORCE.

Croix de Guerre.

Major John Vincent Hume Guest, 8th Field Ambulance, Australian Army Medical Corps.

Lieut.-Col. Alan Frankland Jolley, 9th Australian Field Ambulance, Australian Army Medical Corps.

6845 Pte. Cora Lisle Brealey, 15th Field Ambulance, Australian Army Medical Corps.

1690 Serjt. William Harold Eggington, 8th Field Ambulance, Australian Army Medical Corps.

9771 Lance-Cpl. William Noel Elkin, 1st Field Ambulance, Australian Army Medical Corps.

3863 Pte. Hubert Clifton Ladner, 12th Field Ambulance, Australian Army Medical Corps.

2791 Drvr. (Lance-Cpl.) William Lawrence, 5th Field Ambulance, Australian Army Medical Corps.

5515 Pte. George Joseph O'Neill, 4th Field Ambulance, Australian Army Medical Corps.

8700 Pte. Samuel Albert St. Clair, 14th Field Ambulance, Austalian Army Medical Corps.

2170A Cpl. Leo William Walker, 11th Field Ambulance, Australian Army Medical Corps.

NEW ZEALAND FORCE.

3/549 Pte. Ewen McGregor Hunter, 2nd Field Ambulance, New Zealand Medical Corps.
3/424 Serjt. George Leslie Miller, 3rd Field Ambulance, New Zealand Medical Corps.

CORRECTION.

Croix de Guerre (French).

London Gazette, May 1, 1917.

Page 4160.—3532 Pte. John William Stephenson, Royal Army Medical Corps, attached 65th Battery, Royal Field Artillery, is now correctly described.

War Office,
April 7, 1919.

The names of the undermentioned Officers are brought to notice for gallant and distinguished service rendered in connexion with the military operations at Aden during the period from August 16, 1917, to January 31, 1919:—

ROYAL ARMY MEDICAL CORPS.

Lieut.-Col. E. P. Connolly.
Capt. D. T. Richardson, M.B.

INDIAN MEDICAL SERVICE.

Lieut.-Col. T. H. Foulkes, F.R.C.S.
Major (Temp. Lieut.-Col.) I. M. Macrae, M.B.
Temp. Capt. M. H. Pillai, M.B.

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

St. James's Palace,
April 15, 1919.

The King has been graciously pleased to command, on the recommendation of the Secretary of State for War, that the following appointments to, and promotions in, the order of the British Empire, which were published in the *London Gazette* on the dates stated, shall be transferred to the Military Division of the Order, in terms of the notification published in the *London Gazette*, No. 31804, of December 27, 1918:—

COMMANDER.

Lieut.-Col. John Tweedy Lewtas, Royal Army Medical Corps, January 7, 1918.

OFFICERS.

Major and Qmr. Henry Joseph Francis Audus, Royal Army Medical Corps, June 7, 1918.
Temp. Capt. David Forbes Borrie, Royal Army Medical Corps, November 18, 1918.
Lieut.-Col. Alexander Bruce, Royal Army Medical Corps, June 7, 1918.
Major Edward John Buckley, Royal Army Medical Corps, June 7, 1918.
Lieut.-Col. Joseph Dalrymple, Royal Army Medical Corps, June 7, 1918.
Lieut.-Col. Bertram Ramsey Dennis, M.B., Royal Army Medical Corps, June 7, 1918.
Major Charles Sempill De Segundo, V.D., M.B., B.C., Royal Army Medical Corps, January 8, 1919.
Capt. William Dunlop, Royal Army Medical Corps (Special Reserve), November 18, 1918.
Major William Bickerton Edwards, Royal Army Medical Corps, June 7, 1918.
Lieut.-Col. Charles Edward Percy Fowler, Royal Army Medical Corps, March 15, 1918.
Capt. David Hammand Fraser, M.C., Royal Army Medical Corps, November 18, 1918.
Major Edward Gibbon, M.B., Royal Army Medical Corps, November 18, 1918.
Capt. Richard Edward Gibson, Royal Army Medical Corps, June 7, 1918.
Temp. Capt. Edward Norman Glover, Royal Army Medical Corps, November 18, 1918.
Major John Green, Royal Army Medical Corps, June 7, 1918.
Lieut.-Col. John Alexander Gunn, Canadian Army Medical Corps, June 7, 1918.
Capt. John Molyneux Hamill, Royal Army Medical Corps, June 7, 1918.
Temp. Lieut.-Col. Donald Macaulay, Royal Army Medical Corps, November 18, 1918.
Major Frederick Percival Mackie, M.D., F.R.C.S., Indian Medical Service, November 18, 1918.
Major William Lewis Martin, Royal Army Medical Corps, June 7, 1918.
Capt. William Percival Mulligan, M.B., Royal Army Medical Corps, June 7, 1918.
Lieut.-Col. Charles Duncan Myles, Royal Army Medical Corps, June 7, 1918.
Capt. John Glyn, Royal Army Medical Corps, June 7, 1918.
Lieut.-Col. Ernest Reinhold Rost, Indian Medical Service, November 18, 1918.
Major Charles Edward Southon, M.B., Indian Medical Service, November 18, 1918.
Major Alexander Lewis Urquhart, Royal Army Medical Corps, June 7, 1918.
Capt. John Wallace, Royal Army Medical Corps, June 7, 1918.
Major John Wilson, Royal Army Medical Corps, June 7, 1918.
Brevet Col. German Sims Woodhead, V.D., Army Medical Service, January 7, 1918.

MEMBERS.

Lieut.-Col. Harry Hyndham Balfour, Royal Army Medical Corps, January 7, 1918.
Capt. Raymond Bury, Nyasaland Medical Service, November 18, 1918.
Temp. Capt. Geoffrey Douglas Hale Carpenter, Uganda Medical Service, November 18, 1918.
Capt. Wilberforce Vaughan Raves, Royal Army Medical Corps, June 7, 1918.
Capt. William Herron Elliott, Royal Army Medical Corps (Special Reserve), November 18, 1918.

Capt. Geoffrey Balance Fleming, Royal Army Medical Corps (Territorial Force), November 18, 1918.

Capt. Alfred Harwood, Royal Army Medical Corps, June 7, 1918.

Major Harold Octavius Lethbridge, Royal Army Medical Corps, June 7, 1918.

Temp. Capt. Donald McIntyre, Royal Army Medical Corps, November 18, 1918.

Lieut. John Ritchie, M.B., Royal Army Medical Corps, June 7, 1918.

April 17, 1919.

His Majesty the King has been graciously pleased to approve of the award of the Distinguished Conduct Medal to the undermentioned Non-commissioned Officers and Men, for Gallantry and Distinguished Service in the Field. The acts of gallantry for which the decoration has been awarded will be announced in the *London Gazette*, as early as practicable:—

403243 Serjt J. F. Hind, M.M., 1/2nd (West Riding) Field Ambulance, Royal Army Medical Corps, Territorial Force (York).

26318 Pte. H. E. Moorcock, M.M., 71st Field Ambulance, Royal Army Medical Corps (Maidenhead).

10904 Pte. Acting-Serjt. C. Parker, M.M., 69th Field Ambulance (Italy), Royal Army Medical Corps (Pontefract).

45684 Serjt. (Acting Staff-Serjt.) H. J. Wheeler, M.M., 56th Field Ambulance, Royal Army Medical Corps (Hythe).

ROYAL ARMY MEDICAL CORPS CENTRAL MESS FUND.

The Committee beg to submit a short Report on this Fund for the year ended February 28, 1919.

The number of subscribers has fallen from 775 to 745, mainly owing to retirements. The entrance fees paid were twenty-two (but fourteen others have come in since the end of the year). Notices explaining the object of the Fund and bankers orders have been sent, more than once, to all officers who have been appointed to the Corps during the war, but a very large number of these have failed to reach their destination.

The principal grants made during the year have been to the London Mess for the insurance premiums and the servants pension fund, and to the Aldershot Mess for maintenance purposes. It may be of interest to state that during the past five years the total grants made to Messes have been: London, £491 13s. 6d.; Aldershot, £120; Curragh, £100; Bangalore, £50; Lucknow, £50; Peshawar, £50; Tidworth, £10. Total £871 13s. 6d. It is believed that further calls upon the Fund have been deferred till the end of the war, and that they are likely to be heavy.

It will be seen that during the year £500 from cash surplus has been invested in National War Bonds; the other £200 of these Bonds is a re-investment of the proceeds of the sale of £200 Exchequer Bonds redeemable in 1920. The Committee think that the financial position of the Fund may be regarded as very satisfactory, but the probability of heavy claims in the near future must not be forgotten. It must also be pointed out that in the future the annual expenditure in payment of joining and difference-in-rank contributions on behalf of subscribers, hitherto extremely small, is likely to be largely increased, since from figures obtained from the various Messes at home and abroad, it is estimated that when normal conditions return no less than half the income of the Fund derived from subscriptions will be absorbed in this way.

Of recent years this Committee has been made up of one representative from each District and smaller Command, Aldershot and London having two each. Districts having now ceased to exist the Committee has given careful consideration to its reconstitution. It is of opinion that one member from each Command in the United Kingdom and from the London District, together with one from each of the following messes—London, Aldershot, Netley, Woolwich, Cosham and Curragh—should constitute a Committee thoroughly representative of the Corps, and therefore recommends that this provisional scheme be adopted for one year; the representation of the Indian messes remaining as at present.

Before the War the acquirement by the Central Fund of some, or all, of the Rawal Pindi Mess Debentures was under consideration, as it was thought that not only the Mess, but also the Fund would in the end benefit thereby. The Committee asks for authority to take action in this matter, should the members of the Mess still wish it, and further investigation show that it is desirable.

3, *Homefield Road, Wimbledon, S.W.* J. T. Clapham, *Captain*,
May 5, 1919. *Hon. Secretary*.

The Annual General Meeting of Subscribers to the Royal Army Medical Corps Central Mess Fund will be held in the Library of the Royal Army Medical College on Wednesday, June 11, 1919, following immediately that of the Royal Army Medical Corps Officers' Benevolent Society. The Director-General will preside. Officers desiring information about this Fund are asked to communicate with the Honorary Secretary beforehand, so that there may be no delay in dealing with any questions which may be asked. Notice of any definite proposal which it may be desired to bring forward should be sent to the Honorary Secretary in order that it may appear on the agenda paper. J. T. Clapham, *Captain*,

3, *Homefield Road, Wimbledon, S.W.* *Hon. Secretary*.

ROYAL ARMY MEDICAL CORPS FUND DINNER, 1919.

The Royal Army Medical Corps Fund Dinner will take place at the Savoy Hotel, on Wednesday, June 11, 1919, at 8 p.m., when H.R.H. the Duke of Connaught, Colonel-in-Chief of the Corps, has kindly consented to preside.

In view of the fact that this is the first Dinner after the War, it has been decided to invite, as guests, the attendance of officers who hold, or who have held, Commissions in the Royal Army Medical Corps during the War, whether such Commissions are Temporary, Special Reserve, or Territorial.

Owing to exigencies of space, the number of dining members must necessarily be limited, and in consequence it will only be possible to invite a limited number of guests.

Members of the Fund wishing to dine are requested to send in their names to the Hon. Secretary, R.A.M.C. Dinner Fund Committee, Adastral House, Blackfriars, E.C.4, not later than May 20, 1919. It is very important that application be made before this date in order that the accommodation available for guests may be known.

The price of the dinner to non-subscribers of the Royal Army Medical Corps Fund will be £2 12s. 6d., and to subscribers 7s. 6d.

Dress—Uniform (khaki or blue serge) or evening dress with miniature decorations.

Non-subscribers when applying for tickets should forward the sum of £2 12s. 6d. by cheque or P.O.O. made payable to the Hon. Secretary. The price of the dinner ticket will be collected from subscribers at the Restaurant on the night of the dinner.

The following officers will be regarded as subscribers:—

(1) All existing subscribers to the old Royal Army Medical Corps Dinner Fund, provided they have paid their subscriptions to that Fund for the current year.

(2) All subscribers to the Royal Army Medical Corps Fund* provided their subscriptions are credited to the Fund before the date of the dinner.

Selected musicians from the Royal Army Medical Corps Band will perform during dinner.

Besides one long table, there will be small separate tables to allow of eight officers sitting at each, and these will be reserved for parties of eight officers who wish to dine together, if they will arrange to notify the names to the Hon. Secretary before Monday, June 9.

A plan of the tables will be on view at the Restaurant on the day of the dinner, in order that officers who have not made up parties may select the places at which they wish to sit. A list of officers who have notified their intention of dining will also be on view.

A. R. Wright, *Capt. R.A.M.C.*
Hon. Secretary R.A.M.C. Fund Dinner Committee,
Adastral House, Blackfriars, E.C.4.

ROYAL ARMY MEDICAL CORPS FUND (REGULAR ARMY) AND ROYAL ARMY MEDICAL CORPS OFFICERS' BENEVOLENT SOCIETY (REGULAR ARMY).

The Annual General Meeting of the Royal Army Medical Corps Fund will be held in the Library of the Royal Army Medical Corps College, Grosvenor Road, S.W., at 2.30 p.m., on Wednesday, June 11, 1919. The Director-General will preside. It is hoped that all subscribers who can spare the time will be present, and will freely express their views on any point connected with the Fund.

The Annual General Meeting of the Royal Army Medical Corps Benevolent Society will take place immediately afterwards.

Any officers desiring information regarding these Funds are requested to communicate with the Secretary beforehand, so that there may be no delay in dealing with any questions asked.

124, *Victoria Street, S.W.* E. M. Wilson, *Lieutenant-Colonel,*
April 16. *Secretary.*

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* Officers who have specially excluded the Annual Dinner in the allocation of their subscriptions will, of course, be excepted.

STATEMENT OF ACCOUNTS OF THE ROYAL ARMY MEDICAL CORPS OFFICERS' BENEVOLENT SOCIETY FOR THE YEAR 1918.

Receipts.

				£	s.	d.
To Balance at Bankers', January 1, 1918				296	16	7
,, Subscriptions				316	19	6
,, Donations—						
Lieut.-Col. G. B. Riddick	£25	0	0			
Officers' Mess, Canterbury	40	0	0			
Lieut.-Col. S. Boylan Smith	5	0	0			
Lieut.-Col. W. R. Galwey	2	0	0			
Lieut.-Col. H. S. Anderson	5	0	0			
C. D. Shaw, Esq., Executor to the estate of the late Major W. A. Ward	3	3	0			
				80	3	0
,, Dividends—						
North Eastern Railway 3 % Debenture Stock (*less* tax £52 9s. 10d.)				147	9	8
London and North Western Railway 3 % Debenture Stock (*less* tax £52 10s.)				147	10	2
Midland Railway 2½ % Debenture Stock (*less* tax £42)				118	0	0
Caledonian Railway 4 % Debenture Stock (*less* tax £31 3s. 7d.)				80	0	5
Consols (*less* tax £9 2s. 2d.)				24	1	4
War Loan 5 %				22	9	10
Refund of Income Tax, 1917				196	7	6
				£1,429	18	0

Expenditure.

	£	s.	d.
By Grants	850	0	0
,, Office Expenses, 1917	62	1	8
,, Expenses of Issue of Special Appeal	7	4	10
,, Bankers' Charges	0	0	3
,, Auditors Fée, 1917	1	1	0
,, Purchase of National War Bonds	200	0	0
,, Transfer to Auxiliary Fund, part of Grant from Canterbury	20	0	0
	1,140	7	9
,, Balance Credit	289	10	3
	£1,429	18	0

Investments at Cost.

	£	s.	d.
London & North Western Railway 3 % Debenture Stock	6,667	0	0
North Eastern Railway 3 % Debenture Stock	6,666	0	0
Midland Railway 2½ % Debenture Stock	6,400	0	0
Caledonian Railway 4 % Debenture Stock	2,780	0	0
Consols	1,327	7	9
War Loan 5 % £450	427	10	1
National War Bonds 5 % £20	200	0	0
	£24,467	17	10

We have compared the above statement with the books and vouchers relating thereto, and certify it to be correct. We have verified the Bank Balance and the Investments.

Portland House,
Basinghall Street, London, E.C. 2,
April 4, 1919.

(*Signed*) EVANS, PEIRSON & CO.,
Chartered Accountants.

STATEMENT OF ACCOUNTS OF THE OFFICERS BRANCH FOR THE YEAR 1918.

RECEIPTS.	£	s.	d.
To Balance at Bank, December 31, 1917	530	8	10
,, Subscriptions	1,070	7	6
,, Dividends :—			
Caledonian Railway, less Tax	41	11	5
North British Railway, less Tax	43	0	4
£800 National War Bonds 5 %	22	19	0
£2,300 National War Loan 5 %	115	0	0
,, Office Expenses for 1917 repaid by General Relief Branch	62	1	8
,, Office Expenses for 1917 repaid by Benevolent Society	62	1	8
,, Postage for Special Appeal repaid by Benevolent Society	2	0	10
,, Refund from London Telephone Service	2	18	10
	£1,952	10	1

EXPENDITURE.				£	s.	d.
By Grants to Band				180	0	0
,, Fire Insurance for Q.A.M. Hospital Chapel ..				4	5	6
,, Royal School for Officers' Daughters				26	5	0
,, £800 National War Bonds 5 % purchased				800	0	0
,, Capt. J. T. Clapham for Press Cuttings				12	12	0
,, Expenses for transferring Railway Securities ..				2	2	0
,, General Relief Branch voted last year				25	0	0
,, Messrs. Evans, Peirson & Co. (Auditors)				6	6	0
,, Messrs. Ryman, Printing Book of Rules and Circular Letter				10	8	0
,, Messrs. Ryman, Printing Special Letter *re* Distinguished Officers				1	1	0
,, Special Grant under Rule 5				30	0	0
,, Refund of Subscription credited in error				1	0	0
,, Cheque Book				0	4	2
,, Office Expenses :—						
Shorthand Clerk	£1	1	0			
Office Allowance	180	0	0			
Stationery, Printing and Postage ..	18	3	6			
Telephone (including purchase from Auxiliary and Furniture) ..	13	9	0			
Subscription to "Corps News" ..	1	8	2			
				214	1	8
,, Balance at Bank, December 31, 1918				639	4	9
				£1,952	10	1

(Two-thirds of this will be repaid in 1919; one-third by R.A.M.C. Benevolent Society, and one third by the General Relief Branch.)

INVESTMENTS, AT COST.	£	s.	d.
Caledonian Railway 4 % Preference Stock	£1,408	0	0
North British Railway Preference Stock	1,457	0	0
War Loan £2,300 5 %	2,186	7	11
National War Bonds 5 %	800	0	0
	£5,851	7	11

We have compared the above statement with the books and vouchers relating thereto, and certify it to be correct. We have verified the Bank Balance and the Investments.

Portland House,
Basinghall Street, E.C.
April 17, 1919.

(*Signed*) EVANS, PEIRSON & CO.,
Chartered Accountants.

STATEMENT OF ACCOUNTS OF THE GENERAL RELIEF BRANCH FOR THE YEAR 1918.

RECEIPTS.	£	s.	d.
To Balance in hand, December 31, 1917	505	5	4
,, Grants from Companies and Units	1,030	0	3
,, Subscriptions and Donations	52	12	11
,, Dividends :—			
£606 1s. 3d. Canada Railway Stock	17	11	6
£1,060 East India Railway Stock	26	8	7
£2,926 War Loan 5 %	146	6	2
£1,000 Exchequer Bonds 6 %	30	0	0
£2,300 National War Bonds	53	13	7
Refund of Income Tax, 1917	27	5	0
Sold £1,000 Exchequer Bonds 6 %	1,038	16	7
Schools Account, as per attached Statement	100	10	6
	£3,028	10	5

EXPENDITURE.	£	s.	d.
By Grants to Soldiers and Widows, &c.	50	0	0
,, Union Jack Club	25	4	0
,, Incorporated Soldiers and Sailors Help Society	5	0	0
,, National Association for Employment of ex-Soldiers	5	0	0
,, R.A.M.C. P.O.W. Fund	25	0	0
,, Army and Navy Male Nurses Co-operation	20	0	0
,, Corps of Commissionaires	10	0	0
,, From 30th General Hospital transferred to Auxiliary R.A.M.C. Fund	55	0	0
,, From 30th General Hospital transferred to Prisoners of War Fund	36	15	0
,, From Surg.-Genl. Lloyd transferred to Prisoners of War Fund	1	0	0
,, Purchased National War Bond "Blackpool"	100	0	0
,, ,, £300 National War Bonds	300	0	0
,, ,, £1,200 ,, ,,	1,200	0	0
,, ,, £500 ,, ,,	500	0	0
,, Office Expenses, 1917	62	1	8
,, Bankers' Charges and Cheque Book	0	7	7
,, Schools Account as per attached statement	41	0	0
	£2,436	8	3
,, Balance Credit	592	2	2
	£3,028	10	5
,, Balance Credit General Relief	532	11	8
,, ,, ,, Schools	59	10	6
	£592	2	2

INVESTMENTS (AT COST).

	£	s.	d.
Canada 3½ % 1930/50 Stock	606	1	3
East India Railway Co. 3½ % Debenture Stock	1,060	0	0
National War Bonds, 5 %	2,800	0	0
War Loan 5 % Inscribed Stock	2,780	0	0
	£7,246	1	3

We have compared the above statement with the books and vouchers relating thereto, and certify it to be correct. We have verified the Bank Balance and the Investments.

Portland House,
Basinghall Street, E.C.
April 17, 1919.

(*Signed*) EVANS, PEIRSON & CO.
Chartered Accountants.

STATEMENT OF ACCOUNTS OF THE COMPASSIONATE SCHOOL FUND FOR THE YEAR 1918.

Receipts.	£	s.	d.	Expenditure.	£	s.	d.
To Balance in hand, December 31, 1917..	98	0	5	By Royal School at Hampstead	19	0	0
,, Interest on Deposit Account	2	10	1	,, Royal Drummond Institute, Dublin..	12	0	0
				,, Home for Destitute Catholic Children	10	0	0
					41	0	0
				,, Balance credit	59	10	6
	£100	10	6		£100	10	6

Deposit Account 100 0 0

STATEMENT OF ACCOUNTS OF THE ROYAL ARMY MEDICAL CORPS PRISONERS OF WAR FUND, 1918-19.

RECEIPTS.

	£ s. d.	£ s. d.
To Balance in hand, 1917		623 17 2
Grants and Donations from Individual Officers	£1,433 13 0	
Units at Home and Abroad, including Officers	23,338 14 1	
		24,772 7 1
Amount realized by Stores left on hand		790 2 6
,, ,, Sale of Addressograph		14 0 0
Interest on Deposit Account		6 18 1
Sale of Treasury Bills		1,983 18 8
		£28,191 3 6

EXPENDITURE.

	£ s. d.	£ s. d.
By Addressograph Co.	49 3 2	
Army and Navy Stores	355 6 5	
Blackburn P.O.W. Fund	30 14 0	
Central P.O.W. Committee	23,103 16 2	
Committee Internationale de la Croix Rouge	34 0 0	
Customs and Excise	320 8 11	
Messrs. Dray & Sons	170 14 8	
Empire Service	27 10 0	
Messrs. Gamage	22 10 0	
Messrs. Lakeman	4 15 0	
Martin's Tobacco	6 15 0	
Messrs. Morton	24 16 5	
News of the World	7 17 5	
North Hants' Printing Co.	125 9 8	
Oxo Ltd.	21 12 0	
Portsmouth P.O.W. Fund	32 19 6	
Poulter & Sons	17 2 6	
Messrs. Swainston	590 14 6	
Walker's Tobacco Trust	69 8 4	
Office Expenses: Salaries, Postage, etc.	317 14 5	
Charge for Circulars to Officers, Stamping Banker's Order Forms, Cheques, and Cheque Books	48 15 7	
Bills, total		25,382 3 8
Transferred to Auxiliary Fund		82 15 8
Paid Bank of England for £2,000 Treasury Bills and Banker's Charges		1,964 19 2
Unpaid Drafts		5 11 6
Refund of Unused Subscription—Mrs. Varndin		5 0 0
Refund of Unexpended Balance Railway Clearing House		29 10 3
Amount credited in Error		3 18 5
		£27,473 18 8
Balance as per Pass Book	£715 13 9	
Petty Cash in hand	1 11 1	
		717 4 10
		£28,191 3 6

Outstanding Cheques to be brought to Account.

	£ s. d.
Army and Navy Stores	£1 4 3
American Red Cross Society	2 1 10

May 2, 1919.

Audited and found correct.
EDMOND T. GANN.

E. M. WILSON, *Lieut.-Col.*,
Hon. Treasurer.

ROYAL ARMY MEDICAL CORPS PRISONERS OF WAR FUND.

(OFFICIAL CARE COMMITTEE RECOGNIZED BY THE WAR OFFICE FOR THE ROYAL ARMY MEDICAL CORPS.)

THE following is the seventh and final list of donations from units at home and abroad to the above Fund, and an audited statement of accounts is appended. The delay in publication is due to the fact that various small sums were outstanding which have now been settled with two exceptions.

At the last meeting of the Ladies' Committee, an account of which appears in CORPS NEWS for March, it was decided that any remaining credit balance should be divided between the General Relief Branches of the Royal Army Medical Corps Fund and the Auxiliary Royal Army Medical Corps Fund in the proportion of one-third to the former and two-thirds to the latter

It is hoped that all our generous supporters will approve of the decision and will be glad to learn that the unexpended portions of their subscriptions will be utilized for the benefit of dependants of Warrant and Non-commissioned Officers and men of the Corps as a whole.

As Secretary of the Royal Army Medical Corps Fund I shall be glad to hear of any cases of distress among men of the Regular Royal Army Medical Corps, which may come to the knowledge of officers of the Corps, and I am sure that the Hon. Secretary of the Auxiliary Royal Army Medical Corps Fund will be equally ready to deal with similar cases among men of the New Armies, Special Reserve or Territorial Forces if reported to his office at 11, Chandos Street, Cavendish Square.

E. M. WILSON, *Lieutenant-Colonel.*
Hon. Treasurer, Royal Army Medical Corps Prisoners of War Fund and Secretary of the Royal Army Medical Corps Fund.

124, *Victoria Street, S.W.* 1.
May 5, 1919.

SEVENTH AND FINAL LIST.

March 20, 1919.

LIST OF COMPANIES AND UNITS AT HOME AND ABROAD CONTRIBUTIONS TO PRISONERS OF WAR FUND IN 1918 AND 1919.

46th Field Ambulance, accidentally omitted	£30	8	8
Balance of donation, 12th Corps, France, accidentally omitted ..	57	12	0
November 18—			
33rd British General Hospital, Mesopotamia	32	14	6
Victoria War Hospital, Bombay, Sports Fund	11	7	7
3rd Training Battalion, Blackpool (monthly subscription) ..	5	0	0
November 20—			
R.A.M.C. Detachment, Gosport	1	1	3
Hospital Ship "Basra," Mesopotamia .. 36 rupees			
4th Southern General Hospital, Church Service	2	14	6
November 22—			
4th Training Battalion, Blackpool	4	3	4
5th Training Battalion, Blackpool	12	1	10
November 25—			
2nd Wessex P.O.W. Fund (8th donation)	80	0	0
35th Company, London.. ..	20	0	0
4th Training Battalion, Blackpool	5	0	0
November 26—			
6th Training Battalion, Blackpool	5	0	0
November 29—			
No. 17th Company, Curragh ..	£3	13	9
33rd Casualty Clearing Station..	4	2	0
14th Casualty Clearing Station, Beira, East Africa (Officers, N.C.O.s and men)	13	0	0
November 30—			
No. 2 British General Hospital, Mesopotamia (N.C.O.s and men)	12	12	0
December 3—			
6th Training Battalion, Blackpool	1	7	2
27th General Hospital, Egypt ..	20	0	0
December 9—			
3rd Training Battalion, Blackpool	20	0	0
December 10—			
333rd East Anglian Field Ambulance	4	0	0
Colaba War Hospital, Bombay, Sports Club	51	15	0
R.A.M.C. Magazine, Blackpool	0	15	6
Citadel Hospital, Cairo	5	0	0
December 14—			
1st Western General Hospital, Liverpool	8	1	0
December 17—			
Officers R.A.M.C. Mess, Hastings	10	0	0

December 20—	
1/3rd Northumberland Field Ambulance	£10 0 0
Detachment, R.A.M.C., Birr, 17th Company	0 8 6
December 31—	
131st Field Ambulance	11 0 0
R.A.M.C. Officers School of Instruction, Blackpool	8 4 6
January 2, 1919—	
4th Training Battalion, Blackpool	10 0 0
January 8—	
No. 1 Company, Aldershot, Serjeants' Mess	10 0 0
Queen Mary's Military Hospital, Whalley	50 0 0
Concert Party, R.A.M.C. Depot, Blackpool	25 0 0
Units, Lines of Communication, Mesopotamia	£166 4 0
34th Welsh General Hospital, Officers, Sisters, etc., Deolali	47 16 8
Detachment, R.A.M.C., Reception Room, Kantara, Eygpt ..	1 3 6
January 20—	
4th Training Battalion, Blackpool	10 0 0
February 18—	
34th Company, R.A.M.C. Singapore (additional)	10 11 2
Detachment at Kinmel Park (final donation)	5 1 3
March 29—	
D.D.M.S. Lines of Communication, Mesopotamia	10 10 2

OBITUARY.

LIEUT.-COL. JOHN EDWARD HODGSON, O.B.E.

Lieut.-Col. J. E. Hodgson, who died on November 5, 1918, at Dedeagatch, Bulgaria, while with the British Salonika Force, was eldest son of the late Caleb Hodgson, of Carlisle, and stepson of the late Colonel J. J. Durant. He was educated at Grosvenor House School, Carlisle, in France, and at Owens College, Manchester, and took the diplomas of the Conjoint Board in 1898; State Medicine, Royal Army Medical College in 1910; and the D.P.H.London in 1913. After acting as Resident Clinical Assistant at the Barnes Convalescent Hospital, Cheadle, he entered the Royal Army Medical Corps as Lieutenant in January, 1899, and during 1899-1900 served in the South African War. He took part in the advance on Kimberley, including the actions at Belmont, Enslin, Modder River and Magersfontein, and was awarded the Queen's Medal with two clasps. After serving at Dover, he proceeded to India in 1901, and was appointed Staff Surgeon, Fort William, Calcutta, which appointment he held for three and a-half years, finishing his tour of foreign service at Ranikhet. He was gazetted Captain in January, 1902, Major 1910 and Lieutenant-Colonel in 1915. After serving over three years in the London district, Col. Hodgson was appointed Sanitary Specialist, Northern Command, in January, 1914, and in August, 1916, was appointed A.D.M.S. 12th Corps, British Salonika Force, and there served, with only one short leave, until his death, which was due to pneumonia, following on influenza. Colonel Hodgson was twice mentioned in dispatches for his services in Salonika, and was awarded the O.B.E. (Military Division). He leaves a widow and one son.

A Chaplain to the Salonika Force writes: "We have all been the better for knowing him. His strong manliness and his high ideals and his great devotion to duty were an example to everyone."

EXCHANGES, &c.

The charge for inserting Notices respecting Exchanges in the Royal Army Medical Corps is 5/- for not more than five lines, which should be forwarded by Cheque or P.O.O., with the notice, to Messrs. G. STREET and CO., Ltd., 8, Serle Street, London, W.C., not later than the 22nd of the month.

A free issue of twenty-five reprints will be made to contributors of Original Communications, and of twenty-five excerpts of Lectures, Travels and Proceedings of the United Services Medical Society.

Any demand for reprints, additional to the above, or for excerpts, must be forwarded at the time of submission of the article for publication, and will be charged for at the following rates, and additional copies at proportionate rates:—

Number of Reprints	Number of Pages	Cost of Reprints	Cost of EXCERPTS*	Extra for Covers for Reprints: As Journal, Printed on Front	As Journal, Plain, Unprinted	Cheaper Paper, Printed on Front	Cheaper Paper, Plain, Unprinted
		£ s. d.	£ s. d.	s. d.	s. d.	s. d.	s. d.
12	4	0 2 9	0 1 2	4 3	1 1	3 10	0 9
	8	0 5 0	0 2 3				
	16	0 8 3	0 3 11				
25	4	0 3 4	0 1 5	4 10	1 6	4 4	0 11
	8	0 6 0	0 2 9				
	16	0 10 6	0 5 0				
50	4	0 4 6	0 1 10	6 0	2 1	4 10	1 2
	8	0 7 6	0 3 6				
	16	0 13 3	0 5 10				
100	4	0 6 0	0 3 1	7 10	3 11	6 7	2 5
	8	0 10 0	0 4 10				
	16	0 18 6	0 7 6				
200	4	0 9 6	0 4 5	10 10	7 6	9 0	4 10
	8	0 15 0	0 6 7				
	16	1 6 0	0 9 8				

* These are not arranged as Reprints, but appear precisely as in the Journal with any other matter that may happen to appear on the first and last pages of the particular excerpt ordered.

Cases for Binding Volumes.—Strong and useful cases for binding can be obtained from the publishers at the undermentioned rates:—

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The above figures are subject to 25 per cent increase.

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G. STREET & CO., Ltd., 8, Serle Street, London, W.C.

The back outside cover is not available for advertisements.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are inserted free of charge to subscribers and members of the Corps. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS," 324, Adastral House, Victoria Embankment, E.C. 4.

A communication has been received from Major F. C. Pybus.

The following publications have been received:—

British: The Journal of State Medicine, The British Journal of Tuberculosis, The Hospital, The Medical Press, The Journal of the Royal Naval Medical Service, Guy's Hospital Gazette, The Medical Journal of Australia, The British Journal of Surgery, Tropical Veterinary Review, The Medical Journal of South Africa, The Medical Review, Tropical Diseases Bulletin, Bulletin of Entomological Research, Transactions of the Society of Tropical Medicine and Hygiene, The Journal of Tropical Medicine and Hygiene, Proceedings of the Royal Society of Medicine.

Foreign: Archives de Médecine et de Pharmacie Militaires, Surgery, Gynæcology and Obstetrics, United States Public Health Service, The Journal of Infectious Diseases, Annali di Medicina Navale e Coloniale, Archives Médicales Belges, Archives de Médecine et Pharmacie Navale.

MANAGER'S NOTICES.

The JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is published monthly, six months constituting one volume, a volume commencing on 1st July and 1st January of each year.

The Annual Subscription is £1 (which includes postage), and should commence either on 1st July or 1st January; but if a subscriber wishes to commence at any other month he may do so by paying for the odd months between 1st July and 1st January at the rate of 1s. 8d. (one shilling and eightpence) per copy. (All subscriptions are payable in advance.)

Single copies can be obtained at the rate of 2s. per copy.

The Corps News is also issued separately from the Journal, and can be subscribed for at the rate of 2s. (two shillings) per annum, including postage. Subscriptions should commence from 1st July each year; but if intending subscribers wish to commence from any other month, they may do so by paying for the odd months at the rate of 2d. per copy. (All subscriptions are payable in advance.)

Officers of the Royal Army Medical Corps possessing Diplomas in Public Health, etc., are kindly requested to register their special qualifications at the War Office. Letters of complaint are frequently received from officers stating that their special qualifications have not been shown in the Distribution List which is published as a supplement to the Journal in April and October of each year. As, however, the particulars of this list are supplied from official sources, officers are reminded that unless the possession of Diplomas, etc., has been registered at the War Office, no entry of such qualifications can be recorded in the Distribution List.

Letters notifying change of address should be sent to the Hon. Manager, "Journal of the Royal Army Medical Corps," 25, Adastral House, Victoria Embankment, E.C. 4, and must reach there not later than the 20th of each month for the alteration to be made for the following month's issue.

It is requested that all Cheques or Postal Orders for Subscriptions to the Journal, Corps News, Reprints, etc., be crossed "Holt & Co.," and made payable to the "Hon. Manager, Journal R.A.M.C.," and not to any individual personally.

All communications for the Hon. Manager regarding subscriptions, etc., should be addressed to

THE HON. MANAGER,
"JOURNAL OF THE ROYAL ARMY MEDICAL CORPS,"
25, ADASTRAL HOUSE, VICTORIA EMBANKMENT, E.C.4.

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

JUNE, 1919.

EXTRACTS FROM THE "LONDON GAZETTE."

War Office,
April 30, 1919.

EGYPT.

The name of the undermentioned is to be added to those brought to notice for gallant and distinguished conduct in the field by General Sir A. Murray, G.C.M.G., K.C.B., C.V.O., D.S.O., late Commander-in-Chief, Egyptian Expeditionary Force, in his dispatch of June 28, 1917. (Published in the supplement of the *London Gazette*, dated January 12, 1918, No. 30474.)

Capt. J. H. Beilby, M.B., Royal Army Medical Corps (T.F.), attached Worcestershire Yeomanry (T.F.).

MESOPOTAMIA.

The names of the undermentioned officers are to be added to those brought to notice for distinguished and gallant services and devotion to duty by Lieut.-Gen. Sir W. R. Marshall, K.C.B., K.C.S.I., Commanding-in-Chief, Mesopotamian Expeditionary Forces, in his Dispatch of November 11, 1918. (Published in the supplement of the *London Gazette*, dated February 21, 1919, No. 31195.)

Lieut. Col. (Temp. Col.) J. H. R. Bond, D.S.O., Royal Army Medical Corps.
Major J. H. Brunskill, D.S.O., Royal Army Medical Corps.
Temp. Capt. W. A. Cardwell, M.B., Royal Army Medical Corps.
Major (Acting Lieut.-Col.) G. E. Cathcart, Royal Army Medical Corps.
Capt. R. A. Chambers, M.B., Indian Medical Service.
Temp. Capt. G. H. Davy, M.B., Royal Army Medical Corps.
Capt. J. R. Harris, Royal Army Medical Corps (Special Reserve).
Major H. L. Howell, M.C., Royal Army Medical Corps.
Temp. Major Scott, M.B., F.R.C.S., Royal Army Medical Corps.
Capt. F. T. H. Wood, M.B., Royal Army Medical Corps (Territorial Force).

AMENDMENTS TO MENTIONS IN DISPATCHES.

The undermentioned are now correctly described:—

France.

London Gazette, dated December 31, 1918 (No. 31,089).

Capt. J. E. L. Simcox, New Zealand Medical Corps.

Egypt.

London Gazette dated October 7, 1918 (No. 30939).

Col. E. J. R. Evatt, M.B., Royal Army Medical Corps (Territorial Force).

Hospital Ships.

London Gazette, dated September 6, 1918 (No. 30886).

Major H. E. Priestley, C.M.G., Royal Army Medical Corps.

London Gazette, dated March 13, 1919 (No. 31228).

Temp. Major H. T. L. Roberts, Royal Army Medical Corps.

Prisoners of War in Germany.

London Gazette, dated January 10, 1919 (No. 31117).

Capt. A. A. Sutcliffe, Royal Army Medical Corps (since deceased).

East Africa.

London Gazette, dated February 8, 1917 (No. 29933).

6018 Qmr.-Serjt. C. H. Berger, E. A. Medical Service.

London Gazette, dated August 6, 1918 (No. 30829).

Temp. Capt. Alexander Moxon Webber, F.R.C.S., Royal Army Medical Corps.

ARMY MEDICAL SERVICE.

Capt. A. D. Stirling, D.S.O., M.B., to be a Deputy Assistant Director General (temporary) to complete establishment and to be Temporary Major whilst so employed, dated April 29, 1919.

Major-Gen. (Temp. Lieut.-Gen.) Sir C. H. Burtchaell, K.C.B., C.M.G., M.B., K.H.S., relinquishes his temporary rank on re-posting, dated March 16, 1919.

Lieut.-Col. Edwin Charles Hayes retires on retired pay, dated May 10, 1919.

Temp. Major (Acting Lieut.-Col.) Charles S. Young (Captain, Royal Army Medical Corps, Territorial Force), relinquishes his temporary commission on re-posting, dated March 18, 1919.

Temp. Major Henry E. L. Canney, M.D., relinquishes his commission, dated April 4, 1919, and retains the rank of Major.

Major and Brevet-Col. John S. Bostock, M.B., is seconded for service with the Ministry of Pensions, dated March 3, 1919.

Lieut. (Temp. Capt.) William Hunt, M.C., M.B., is seconded for service with the Egyptian Army, dated February 27, 1919.

Capt. Charles G. G. Keane, to be Acting Major, dated October 21, 1918.

Major-Gen. (Temp. Lieut.-Gen.) Sir William Babtie, V.C., K.C.M.G., C.B., M.B., K.H.S., is placed on retired pay, dated May 7, 1919, and to retain the rank of Lieutenant-General.

Major and Brevet Lieut.-Col. S. L. Pallant, D.S.O., relinquishes the temporary rank of Lieutenant-Colonel on re-posting, dated February 28, 1919.

Temp. Col. William T. Lister, M.B., F.R.C.S., relinquishes his commission, dated March 19, 1919, and retains the rank of Colonel.

Col. Robert W. Wright, C.M.G., retires on retired pay, dated March 14, 1919 (substituted for the notification in the *Gazette*, March 5, 1919).

Temp. Lieut.-Col. Herbert G. G. Cook, M.D., relinquishes his commission on ceasing to serve with the Welsh Hospital, Netley, dated April 1, 1919, and retains the rank of Lieutenant-Colonel.

Lieut.-Col. H. R. Bateman, D.S.O., to be Acting Colonel while employed as A.D.M.S. of a Division, dated February 21, 1919.

Lieut.-Col. Augustus H. O. Young retires on retired pay, dated May 17, 1919.

The undermentioned Lieutenant-Colonels relinquish the acting rank of Colonel on re-posting:—

Dated March 1, 1919.—J. A. Hartigan, C.M.G., D.S.O., M.B.
Dated March 3, 1919.—H. A. L. Howell, C.M.G.
Dated March 5, 1919.—C. R. Evans, D.S.O.
Dated March 8, 1919.—A. H. Safford.
Dated March 12, 1919.—J. P. Silver, D.S.O.
Dated March 14, 1919.—W. Riach, C.M.G., M.D.

The undermentioned relinquish the acting rank of Lieutenant-Colonel on re-posting:—

Dated January 12, 1919.—Major P. J. Hanafin.
Dated January 24, 1919.—Major R. E. Humfrey, C.M.G., M.B.
Dated February 8, 1919.—Major J. W. L. Scott.
Dated February 14, 1919.—Temp. Capt. C. V. Bulstrode, D.S.O.
Dated February 15, 1919.—Capt. T. S. Eves, D.S.O.
Dated February 24, 1919.—Capt. and Bt. Major J. D. Kidd, M.C., M.B.
Dated March 15, 1919.—Major R. Storrs.
Dated March 17, 1919.—Major S. M. W. Meadows, D.S.O.
Dated March 27, 1919.—Capt. A. M. Pollard, D.S.O.
Dated March 30, 1919.—Capt. E. C. Lang, D.S.O.
Dated March 31, 1919.—Major E. T. Potts, C.M.G., D.S.O., M.D.
Dated April 1, 1919.—Major S. E. Lewis, M.B.
Dated April 8, 1919.—Capt. R. W. Galloway, M.B.
Dated April 9, 1919.—Capt. A. N. R. McNeill, D.S.O., M.B.
Dated April 12, 1919.—Capt. S. D. Large, D.S.O., M.C.

The undermentioned relinquish the acting rank of Lieutenant-Colonel:—

Dated March 6, 1919.—Capt. I. R. Hudleston (on re-posting).
Dated March 18, 1919.—Temp. Capt. J. W. Bennett.

The undermentioned to be Acting Lieutenant-Colonels:—

Dated November 17, 1918.—Major A. J. Williamson.
Dated October 26 to November 1, 1918.—Capt. E. Catford.
Dated February 19, 1919.—Captain (Acting Major) R. R. Thompson, M.C.

The undermentioned Captains relinquish the acting rank of Major:—
Dated February 13, 1919.—D. W. Pailthorpe, M.C.
Dated February 23, 1919.—A. Hendry, M.B.
Dated March 6, 1919.—A. D. Stirling, D.S.O., M.B.
Dated March 11, 1919.—C. A. Bernard, M.C.
Dated March 15, 1919.—H. S. Milne, M.C., M.D.
Dated March 17, 1919.—T. C. R. Archer.
Dated March 31, 1919.—J. Biggam, M.C., M.B.
Dated April 1, 1919.—R. L. Ritchie, M.B.
Dated April 10, 1919.—T. I. Dunn, D.S.O., M.C., M.B.
The undermentioned Lieutenants (Temporary Captains) to be Captains:—
Dated April, 1, 1919.—(Acting Major) M. B. King, M.C., M.B., and to retain his acting rank: J. H. C. Walker, M.B.
Dated April 6, 1919.—W. Hunt, M.C., M.B.
Dated April 7, 1919.—W. L. Partridge, M.C.
Dated April 14, 1919.—H. J. Bower.
The undermentioned Captains to be Acting Majors:—
Dated June 10, 1918.—J. K. Gaunt, M.B.
Dated October 22, 1918.—A. L. Stevenson, M.B.
Dated October 23, 1918.—Capt. J. M. Weddell.
Dated December 17, 1918.—R. R. Thompson, M.C.
Dated January 8, 1919.—Capt. C. Kelly, M.C., M.D.
Dated February 8, 1919.—Capt. J. P. Litt, M.D.; J. W. Littlejohn, M.C., M.D.; J. R. Yourell, M.B.; H. P. Hart, M.C., M.B.
The undermentioned to be Acting Major:—
Dated February 12, 1919.—Capt. R. C. Aitchison, M.B.
The undermentioned Temporary Captains to be Acting Majors:—
Dated February 3 to 28, 1919.—A. G. P. Hardwick.
Dated February 18, 1919.—C. V. Shackleton, M.B.
The undermentioned Captains to be Acting Majors:—
Dated April 1, 1919.—C. T. V. Benson.
Dated March 27, 1919.—G. G. Collet, M.B.
The undermentioned Captains relinquish the acting rank of Major:—
Dated April 5, 1919.—K. P. MacKenzie.
Dated August 19, 1918.—H. P. Rudolf.
Dated October 7, 1918.—H. P. Hart, M.C., M.B.
Dated October 8, 1918.—J. P. Little.
Dated January 14, 1919.—N. V. Lothian.
Dated February 11, 1919.—D. C. G. Ballingall, M.C.
Dated February 13. 1919.—J. A. Andrews, M.C.
Dated February 25, 1919.—D. Bell.
Dated April 1, 1919.—J. M. MacKenzie.
The undermentioned to be Captains, but not to reckon for pay or allowances prior to April 1, 1919, with precedence as stated:—
Dated February 10, 1918.—Captain John Gray Ronaldson, M.C., M.B., from Special Reserve, next below R. A. Hepple.
Dated February 17, 1918.—Temp. Capt. Frederick Charles Atkinson Fleming, M.C., M.B., next below D. C. Monro.
Dated February 28, 1918.—Capt. (Acting Lieut.-Col.) Edmund Tytler Burke, D.S.O., M.B., from Special Reserve, next below R. W. Galloway, and to retain his acting rank.
Dated April 15, 1918.—Capt. Jeremiah John Magner, M.B., from Special Reserve, next below T. K. Boney.
Dated April 15, 1918.—Capt. Thomas Vickers Oldham, M.B., from Territorial Force, next below J. W. Burton.
Dated April 18, 1918.—Capt. Francis Augustus Roddy, M.B., from Special Reserve, next below J. V. Oldham.
Dated April 24, 1918.—Capt. Donald Charles Scott, from Special Reserve, next below T. R. Snelling; Capt. Harold Armstrong Crouch, M.C., from special Reserve, next below D.C. Scott.
Dated June 1, 1918.—Temp. Capt. Walter Stuart Evans, next below M. Morris.
Dated July 4, 1918.—Capt. Wellington John Alexander Laird, from Special Reserve, next below J. H. Baird.
Dated August 15, 1918.—Temp. Capt. Carl Frederick Anthonisz, next below H. E. A. Boldero.
Dated September 1, 1918.—Capt. (Acting Major) Robert Harvey Williams, from Special Reserve, next below W. T. Hare, and to retain his acting rank.
Dated September 23, 1918.—Temp. Capt. Norman Edward Packer, M.B., next below R. D. Davy; Temp. Capt. Arthur Wilmot Raymond, M.C., M.B., next below N. E. Packer.
Dated October 12, 1918.—Temp. Capt. John Travers McConkey, next below R. B. Myles.
Dated October 14, 1918.—Capt. Douglas Cran, M.B., from Special Reserve, next below J. T. McConkey.

Dated November 10, 1918.—Temp. Capt. Harold Earnest Pierpont Yorke, M.C., next below G. S. Douglas,

Dated November 15, 1918.—Capt. Donald McIntyre, M.B.E., M.B., from Special Reserve, next below H. E. P. Yorke.

Dated November 28, 1918.—Temp. Capt. Leslie Wilson Evans. M.B., next below D. McIntyre.

Dated December 18, 1918.—Capt. William McElrea Snodgrass, M.C., M.B., from Special Reserve, next below J. E. Brooks.

Dated January 10, 1919.—Capt. Andrew John Horne, M.B., from Special Reserve, next below J. W. O'Brien.

Dated January 19, 1919.—Capt. Arthur Joseph Beveridge, M.C., M.B., from Special Reserve, next below F. R. H. Mollan.

Dated January 24, 1919.- Capt. Thomas Menzies, M.B., from Special Reserve, next below C. Russell.

Dated February 27, 1919.—Capt. John Taylor Scrogie, M.B., from Special Reserve, next below S. J. L. Lindeman.

Dated March 1, 1919.—Capt. Robert Fowler Walker, M.C., M.B., from Special Reserve. next below J. T. Scrogie.

Dated April 25, 1919.—Capt. William Walford Salisbury Sharpe, from Special Reserve, next below H. J. Bower.

The undermentioned Temporary Captains relinquish their commissions and retain the rank of Captain:—

Dated March 19, 1919.—Edward J. Primrose, M.D.

Dated March 20, 1919.—Donald F. Dobson, M.B.

Dated March 29, 1919.—John L. M. Govan; Adam Gilchrist, M.B.

Dated March 30, 1919.—Edwin Montgomery, F.R.C.S.; William O'Donnell.

Dated March 31, 1919.—William Hamilton, M.C.. M.B.

Dated April 1, 1919.—Percy Kitchin; Hugh A. Edwards, M.B.

Dated April 2, 1919.—John Lambie, M.D.; Edgar A. Shirvell; Charles A. A. Lever.

Dated April 3, 1919.—Arthur G. L. Smith.

Dated April 5, 1919.—Gordon D. Latimer, M.B.

Dated April 8, 1919.—Walter Gilmour, M.D.; Henry F. Smith, M.D.

Dated April 9, 1919.—Hamilton W. Dyke, M.B.; Richard D. Attwood; Clement A. Hughes, M.B.

Dated April 11, 1919.—Smeeton Johnson, M.D.

Dated April 14, 1919.—Michael C. Burke, M.C., M.D.

The undermentioned to be Lieutenants and to be Temporary Captains, but not to reckon for pay or allowances prior to April 1, 1919, with precedence as stated:—

Dated November 14, 1915.—Temp. Capt. Cuthbert Lindsay Emmerson, next below L. S. C. Roche.

Dated December 1, 1915.—Temp. Capt. Geoffrey Dawson Gripper, next below F. A. R. Hacker.

Dated February 25, 1916.—Temp. Capt. Thomas Powrie Buist, M.B., next below W. L. A. Harrison.

Dated March 4, 1916.—Temp. Capt. Archibald Alastair Brace Scott, M.B., next below P. H. Wells.

Dated April 7, 1916.—Capt. John Andrew Crawford, M.B. (from Special Reserve), next below W. H. Ferguson.

Dated April 28, 1916.—Temp. Capt. Percy Reginald O'Rourke Phillips, next below J. A Crawford.

Dated May 12, 1916.—Temp. Capt. Percy Gunn Russell, next below G. T. Garraway.

Dated June 15, 1916.—Temp. Capt. Wilfred Ernest Hodgins, M.B., next below P. G. Russell.

Dated June 24, 1916.—Temp. Capt. Harold Arthur Whyte-Venables, next below W. E. Hodgins.

Dated August 10, 1916.—Capt. Alistair Gibb Stevenson, from Special Reserve, next below T. L. Henderson.

Dated August 22, 1916.—Capt. Benjamin James Daunt, from Special Reserve, next below R. H. C. Pryn.

Dated October 9, 1916.—Capt. Mortimer McGee Russell, M.B. from Special Reserve, next below G. G. Drummond.

Dated January 1, 1917.—Capt. John Philip Macnamara, M.B., from Special Reserve, next below G. E. Spicer.

Dated February 5, 1917.—Capt. Leslie Graham Blackmore, from Special Reserve, next below G. E. L. Simons.

Dated May 1, 1917.—Capt. James Macdonald Morrison, M.B., from Special Reserve, next below V. J. Bonavia.

Dated July 19, 1917.—Capt. Joseph Clinton Collins, from Special Reserve, next below K. Masson.

Dated August 9, 1917.—Capt. John Crawford Burns, M.B., from Special Reserve, next below J. M. Savege.

Dated October 4, 1917.—Temp. Capt. Alexander Richard Barlas, M.B., next below J. C. Burns.

INSPECTION BY FIELD-MARSHAL H.R.H. THE DUKE OF CONNAUGHT.

THE first official inspection of the Royal Army Medical Corps by its first Colonel-in-Chief, which took place in the Army of the Rhine on May 8, 1919, deserves to be recorded as a matter of historical interest in the annals of the Corps.

On the same forenoon, in a review of the Northern Division by His Royal Highness a detachment of Divisional Royal Army Medical Corps 100 strong, under the command of Colonel N. Faichnie, A.D.M.S., had taken part, and had distinguished themselves by their smart turn-out and excellent marching.

As part of his programme, the Duke was timed to visit No. 36 Casualty Clearing Station at 4 p.m., which hospital is sited in a suburb of Cologne.

Advantage was taken of this visit to collect together, by bus and car, from the divisions and hospitals, as many officers, sisters, and "other ranks" as time and circumstances would permit.

The parade was formed up on the tennis grounds of the hospital, no other space being available close at hand. The formation was in hollow square, four deep, lines at intervals of two paces with a line of officers in front, and a supernumerary rank of warrant officers and senior non-commissioned officers behind. All non-commissioned officers up to and including serjeant were in the ranks.

The troops on each of the three sides of the hollow square formed a section under the command of a lieutenant-colonel. On the right, one officer and twenty-four other ranks, Royal Army Service Corps, representing the members of the Royal Army Service Corps Horse and Motor Transport, attached to the Royal Army Medical Corps, paraded as part of No. 1 section.

The strength present was 30 officers and 450 other ranks. In addition, the Principal Matron of the Army, Miss H. W. Reid, R.R.C., 40 nursing sisters, as well as 10 senior officers, and staff officers, Medical Service, and some of the chaplains, were present. These were accommodated on seats along the garden-walk.

The band of the 51st Devonshire Regiment was kindly lent (at a moment's notice) for the occasion.

Lieut.-Colonel W. J. S. Harvey, D.S.O., officer commanding No. 36 Casualty Clearing Station, with Captain T. S. Eves, D.S.O., as his Adjutant was in command of the parade.

On arrival, the Duke was met by the D.M.S., British Army of the Rhine, and conducted to the parade, where he was received with the Royal Salute, the band playing the first six bars of the National Anthem.

The nursing sisters and senior officers were individually presented to him.

His Royal Highness then made a very minute inspection of each section, passing along every rank. The officers in line were presented individually by name. Officers and men wearing decorations were noticed, especially those wearing rosettes indicating bars.

When the inspection was over the Colonel-in-Chief addressed the parade. He said that he fully appreciated the great honour which His Majesty the King had conferred upon him by appointing him to be Colonel-in-Chief of the Royal Army Medical Corps. He was much gratified by having this opportunity of seeing so many members of the Regiment, and he wished to tell them how their gallant and devoted work throughout the war had been followed with sympathetic appreciation and pride by their King and fellow-countrymen.

Their losses had been heavy—540 officers, 300 sisters and upwards of 4,091 non-commissioned officers and men had lost their lives; but they had well upheld the honour and the traditions of the Corps and of the British Army generally.

He sympathized very fully with those whose demobilization was overdue, and he assured them of the sympathy of the Army Authorities, who were doing all they could in the matter. Unfortunately, the military situation had demanded their retention, but he was happy to inform them that he had that day heard some details of a scheme by which the greater part would be released almost immediately.

His Royal Highness then took command as Colonel-in-Chief, gave the order, "Royal Army Medical Corps, attention! caps off, and give three cheers for your King, taking the time from me."

Major-General H. N. Thompson, D.M.S., British Army of the Rhine, as Senior Officer present, thanked His Royal Highness for coming to inspect them, assured him that all ranks fully appreciated the great honour they had received by his appointment, and that they cordially welcomed him into the Corps as its first Colonel-in-Chief. His words were not only grateful to those who were present that day and had heard them, but they would be reported far and wide, and would serve as a source of encouragement and inspiration to the many thousands of their comrades who, in various parts of the world, were striving to do their duty to their King and Country.

General Thompson then gave the order, "Royal Army Medical Corps! caps off again, and give three cheers for our Colonel-in-Chief, taking the time from me."

His Royal Highness was then conducted round the hospital, which, as regards site, appointments, management, etc., is as perfect as a hospital could be.

As the Colonel-in-Chief entered his car to leave, the band again played the National Anthem, and he drove away through groups of men who had been on parade and who now cheered spontaneously.

ARMY MEDICAL OFFICERS' WIDOWS AND ORPHANS FUND.

REPORT OF THE COMMITTEE OF MANAGEMENT TO THE MEMBERS FOR THE YEAR ENDED DECEMBER 31, 1918.

THE Committee beg to present the following Report on the affairs of the Society, and to submit the Accounts for the year ended December 31, 1918.

They regret to record during the past year the deaths of six married and of one unmarried members, amongst them those of two of their valued colleagues, Lieut.-Cols. J. More Reid and P. S. O'Reilly. Three of these members were on the Active List and comparatively young. In two cases death was due to epidemic influenza and pneumonia.

There are six fresh annuitants, of whom four received the £200 bonus, and two that of £100. Two annuitants have died during the year. Two married members have joined. The total number of members is now 160, of whom ten are unmarried. There are seventy-one annuitants.

Mr. R. R. Tilt, F.I.A., has been appointed Consulting Actuary to the Society in the place of the late Mr. H. W. Andras, F.I.A., whose much regretted death in February, 1918, was recorded in the previous Report.

During the past year the Committee with the concurrence of the Actuary, further reduced the extra annual War premium from twenty-five to fifteen guineas per annum: and in accordance, an equivalent refund was made to such members as had already paid the higher rate. The extra charge was, later, altogether suspended till further notice, from the date of the Armistice. The effect of these various reductions and refunds is that members who have joined the Society since the outbreak of the War have only paid an extra War premium of fifteen guineas per annum throughout.

It may be of interest to mention that, so far as can be ascertained, the deaths amongst regular officers of the Corps on the Active List from the outbreak of the War to the Armistice, have been ninety-one in number. Of these there were, killed in action, died of wounds, drowned, or died as prisoners of War a total of sixty-four. As to the remaining twenty-seven it is not yet known in what proportion death was directly or indirectly due to conditions of service. It must, however, be remembered, that the effect of war service in an increased death-rate is likely to be felt in future years.

The financial position of the Fund continues to be extremely satisfactory. While the income from subscriptions remains almost exactly the same as in 1917, that from interest on investments has increased by £433 8s. 4d. Notwithstanding £1,000 having been absorbed by bonuses to widows, in the course of the year it has been possible to invest £5,000 from cash surplus in five per cent National War Bonds, 1928; the Benefit Fund having increased by £5,157 18s. 4d. A valuation of the Securities at middle published prices on December 31, 1918, shows a depreciation of £833 18s. 7d., whereas on December 31, 1917, the depreciation was no less than £3,094 8s. 7d.

It is hoped that members of the Society will continue to bring to the notice of brother officers the advantages of the Fund and its very sound financial position. Notices on this point have been sent, more than once, to all officers who have joined the Corps since the beginning of the War, but probably a large number of these circulars have failed to reach their destination.

The term of five years as Secretary of Captain J. T. Clapham having expired on April 1, 1919, the Committee of Management unanimously re-elected him as Secretary for a further period of five years, at a salary of £250 per annum, with the usual office allowance; subject to confirmation of the Annual General Meeting, in accordance with Rule XXI. His services during the difficult period of the War have been invaluable, which the Committee gratefully acknowledge, and are assured that in his hands the affairs of the Society are, and will be, most excellently conducted.

W. S. M. PRICE,
Major-Gen., A.M.S., Vice-President,
Chairman of the Meeting of this date.

War Office,
April 14, 1919.

ARMY MEDICAL OFFICERS' WIDOWS AND ORPHANS FUND.

ACCOUNTS FOR THE YEAR 1918.

(In the form prescribed for the Annual Return of a Registered Friendly Society.)

(A) BENEFIT FUND.

DR. — INCOME.

Income	£	s.	d.
Members' Subscriptions..	2,318	17	2
Interest on Investments of Benefit Fund (including amounts recoverable in respect of Income Tax) ..	7,627	19	6
Total Income ..	£9,946	16	8
Amount of Benefit Fund at the beginning of the year, as per last Balance Sheet ..	143,665	3	5
	£153,612	0	1

CR. — EXPENDITURE.

Expenditure	£	s.	d.
Widows' Annuities ..	3,436	10	0
Bonuses to Widows ..	1,000	0	0
Refund to Members of proportion of extra War Charges paid in 1915-18 ..	178	10	0
Interest on £5,797 5s. 5d. (balance of Management Fund at the end of the year 1917) at 3 per cent, transferred to Management Fund ..	173	18	4
Total Expenditure ..	£4,788	18	4
Amount of Benefit Fund at the end of the year, as per Balance Sheet (C) ..	148,823	1	9
	£153,612	0	1

(B) MANAGEMENT FUND.

DR. — INCOME.

Income	£	s.	d.
Interest for one year on £5,797 5s. 5d. at 3 per cent, transferred from Benefit Fund ..	173	18	4
Amount of Management Fund at the beginning of the year, as per last Balance Sheet ..	5,797	5	5
	£5,971	3	9

CR. — EXPENDITURE.

Expenditure	£	s.	d.
Secretary's Salary ..	150	0	0
Actuary's Fees ..	7	7	0
Auditors' Fee ..	15	15	0
Office Allowance..	60	0	0
Printing, Postages, and Stationery ..	19	0	0
Total Expenditure ..	£252	2	0
Amount of Management Fund at the end of the year, as per Balance Sheet (C) ..	5,719	1	9
	£5,971	3	9

(C) BALANCE SHEET AT DECEMBER 31, 1918.

DR. LIABILITIES.	£	s.	d.
Benefit Fund, as per Account (A)	148,823	1	9
Management Fund, as per Account (B)	5,719	1	9
Sundry Liabilities—			
Secretary's Salary (from October 1 to December 31, 1918)	37	10	0
Actuary's Fee	5	5	0
Office Allowance	15	0	0
Annuities outstanding	130	0	0
	£154,729	18	6

ASSETS. INVESTMENTS.				Rate per cent of Interest yielded £	s.	d.	CR. £	s.	d.
(1) In the Public Funds—									
£124,000	0	0	War Stock, Five per Cent, 1929-1947 ..	5	5	6	117,507	6	1
3,000	0	0	National War Bonds, Five per Cent, 1927	5	0	0	3,000	0	0
5,000	0	0	National War Bonds, Five per Cent, 1928	5	0	0	5,000	0	0
5,500	0	0	Dominion of Canada Three and a Half per Cent Stock, 1930-1950 (lent to H.M. Treasury at an additional Half per Cent)	5	11	1	3,958	5	8
2,000	0	0	Newfoundland Three and a Half per Cent Stock, 1950 ..	4	16	1	1,456	17	6
(2) Upon the Security of Borough and County Rates, or other Corporate Funds—									
5,000	0	0	London County Council Three and a Half per Cent Stock	4	9	10	3,893	15	0
5,000	0	0	Metropolitan Water Board "B" Three per Cent Stock ..	4	12	1	3,259	7	6
(3) Other Securities—									
5,000	0	0	Great Western Railway Four per Cent Debenture Stock..	4	15	2	4,200	0	0
5,000	0	0	London and North Western Railway Three per Cent Debenture Stock ..	4	13	4	3,215	12	6
1,500	0	0	Caledonian Railway Four per Cent Debenture Stock ..	4	13	4	1,286	5	0
7,900	0	0	Midland Railway Two and a Half per Cent. Debenture Stock ..	4	15	8	4,130	4	4
2,100	0	0	East Indian Railway Three and a Half per Cent Debenture Stock	4	17	7	1,506	15	0
Interest accrued on Investments							1,138	8	6
Income Tax recoverable							90	19	5
Annuity over-paid (since refunded)							26	0	0
Cash at Bankers							1,066	2	0
							£154,729	18	6

NOTE.—A Valuation of the above Securities at middle published prices on December 31, 1918, shows a depreciation of £888 18s. 7d.

To the Members of the Army Medical Officers' Widows and Orphans Fund.

We have examined the above Balance Sheet with the Books and Vouchers of the Society and certify that it is in accordance therewith. The Securities and Cash Balances have been verified by us.

DELOITTE, PLENDER, GRIFFITHS AND CO., } *Auditors,*

Chartered Accountants.

5, *London Wall Buildings, E.C. 2.*

March 27, 1919.

Summary of the Proceedings of a Quarterly Meeting of the Committee which was held at the War Office on April 14, 1919.

Present.

Major-Gen. W. S. M. Price, Vice President, in the Chair.
Major-Gen. Sir H. R. Whitehead, K.C.B.
Major-Gen. Sir W. B. Leishman, K.C.M.G., C.B., F.R.S., K.H.P.
Major W. C. Smales, D.S.O.

(1) The Minutes of the previous meeting were read and confirmed.

(2) The accounts and report for the year 1918 were examined and adopted.

(3) The Annual General Meeting was fixed for Wednesday, May 21, at the War Office.

(4) Major Clive Thornley Edmunds, D.S.O., was admitted a married member from March 15, 1919, at an annual suscription of £21 16s. 4d.

(5) The death was reported of Lieut.-Col. F. M. Mangin on December 31, 1918, and his wife was placed on the list of annuitants, receiving a gratuity of £200.

The death was reported of an annuitant, Mrs. Louisa Kilroy, on February 16, 1919, aged 79.

(6) Payment of annuities for the coming half year was sanctioned.

(7) Payment of audit fee (£15 15s.) to Messrs. Deloitte and Co. was authorized ; as was that of £5 5s. to the Consulting Actuary, being the proportion of the annual fee due to him up to December 31 last.

(8) The Secretary reported the result of a referendum which, as resolved at the Annual General Meeting of 1914, was made in the summer of that year on the question of whether members whose annual subscription exceeds £10 should be given the option of paying.

Such subscription by equal half-yearly instalments, provided always that in the event of the death of a member before the full amount of the current annual subscription had been paid, the balance unpaid shall be deducted from the amount payable to the beneficiary at the death of the member. Replies were received, before the outbreak of war, from eighty-seven members, of whom seven have since died. Of the eighty survivors, seventy-four were in favour of the option being given, one was conditionally so, and five were against the proposal.

It was proposed by Sir Hayward Whitehead, seconded by Sir William Leishman, and carried unanimously—that, as approved by the late and present Actuaries of the Society, such partial amendment of the Rules be made as will give the above option to members whose annual subscription exceeds £10 and that such partial amendment of the Rules be submitted to a special meeting to be called for the purpose, as laid down in Rule XLIX.

(9) In view of the payment of £3,100 interest on £124,000 five per cent War Stock due on June 1 it was resolved unanimously that available cash surplus, not exceeding £3,000 may be invested in National War Bonds five per cent, or in War Stock five per cent as may be considered best by the Actuary and Hon. Treasurer, subject to the approval of the Trustees and that the Secretary be empowered to take the necessary steps.

(10) Payment of the Secretary's salary for the past quarter was sanctioned, as also of office allowance and of petty cash expended by him.

(11) As the present Director-General is not a member of the Society the following Resolution was moved by Sir Hayward Whitehead, seconded by Sir William Leishman and carried unanimously :—

That Lieut.-Gen. Sir John Goodwin, K.C.B., C.M.G., D.S.O., K.H.S., be invited to do members the honour of allowing himself to be proposed at the Annual General Meeting for election as Honorary Member of the Society, and as Hon. President thereof, during his tenure of office as Director-General, and that the Secretary be directed to write to him to that effect.

(12) The Committee considered whether the resolution adopted by them at their last meeting as to the Secretary's salary should not be amended before being submitted to the Annual General Meeting for confirmation. Sir William Leishman proposed and Sir Hayward Whitehead seconded that £250 be substituted for £200 as the Secretary's future salary and that reference be made to the increased cost of living.—Carried unanimously.

J. T. Clapham,
Captain,
Secretary.

3, *Homefield Road,*
Wimbledon, S. W.

ROYAL ARMY MEDICAL CORPS CENTRAL MESS FUND.

Summary of the Proceedings of a Meeting which was held at the Royal Army Medical College, on May 2, 1919.

Present.

Lieut.-Col. F. S. Irvine, C.M.G., D.S.O., representing Aldershot.
Lieut.-Col. W. Benson, D.S.O., representing Rawal Pindi.
Major A. C. H. Gray, representing London.
Major A. M. Benett, representing Western Command.
Capt. L. Murphy, D.S.O., representing Southern Command.

(1) A letter was read from Major H. S. Dickson (Woolwich), regretting his inability to attend.

(2) The minutes of the previous meeting were read and confirmed.

(3) The accounts of the year ended February 28, 1919, were examined and adopted unanimously. The draft of Report to be submitted to the Annual General Meeting was also approved.

(4) Payment of the auditor's fee (£3 3s.) was sanctioned.

(5) A letter in reply to a report for more details was read from the Addington Park Mess, explaining that it was likely to remain open for at least two years more, and stating that several regular officers there were subscribers to the Central Fund. It was resolved that a grant of £20 be made towards the provision of mess equipment, on the understanding that the Central Fund shall have first claim, when the mess closes on any sum which may accrue to the latter from the sale of property so purchased. The Secretary was directed to suggest that any regular officers belonging to the mess who do not yet subscribe to the Central Fund be invited to do so.

(6) The Chairman said that the Aldershot mess was not for the present asking for a renewal of the grant which had been made to it during the past two years, but was waiting till its financial position became more clear.

(7) A letter was read from the P.M.C. Cosham, saying that there seemed more chance of a billiard room being built for that mess by the Royal Engineers, in which case a table might be hired from the Ordnance. Under these circumstances he was not asking the Central Mess Fund to do anything at present. The Committee appreciated the action taken, and placed on record their opinion that any request for help which might be made later on should receive favourable consideration.

(8) There was some discussion on the question of a Corps subscription to the Army Athletic Association. It was considered that the matter could stand over for the present.

(9) Of recent years the Committee has been comprised of one representative from each district and from each of the smaller Commands; London and Aldershot having two each. Districts having now ceased to exist, the Committee gave careful consideration to its reconstitution. It is of opinion that one member from each Command in the United Kingdom, and from the London district, together with one from each of the following messes: London, Aldershot, Netley, Woolwich, Cosham and Curragh—should constitute a Committee thoroughly representative of the Corps, and therefore recommends to the Annual General Meeting that this provisional scheme be adopted for one year; the representation of the Indian messes remaining as at present.

(10) Before the war the acquirement by the Central Mess Fund of some, or all, of the Rawal Pindi mess debentures was under consideration as it was thought that the mess would benefit and also the Fund. This was again discussed, and it was resolved that the General Meeting be asked to allow the Committee to take action in the matter, should further investigation show that it is desirable, and is still desired by members of the mess.

J. T. CLAPHAM,
Captain,
Honorary Secretary.

3, *Homefield Road,*
Wimbledon, S.W.

EXCHANGES, &c.

The charge for inserting Notices respecting Exchanges in the Royal Army Medical Corps is 5/- for not more than five lines, which should be forwarded by Cheque or P.O.O., with the notice, to Messrs. G. STREET and CO., Ltd., 8, Serle Street, London, W.C., not later than the 22nd of the month.

Lieut.-Colonel due for foreign service after the middle of August, probably India, wishes to exchange with officer lower on same roster. "Bonus" according to position on roster. Apply Lieut.-Colonel J. Hay Campbell, R.A.M.C., c/o Messrs. Holt & Co., 3, Whitehall Place, S.W. 1.

FOR SALE.

R.A.M.C. Officer's full kit, made June, 1914, scarcely worn. Includes military frock coat, parade uniform, mess kit, helmet, &c., steel uniform and helmet cases, canvas kit bag, also mufti dress-suit, opera and silk hats. May be seen at T. W. Castle, Military Tailor, 27, Savile Row, W., who will undertake alterations.

MARRIAGE.

HARE—ROWE.—On April 12, 1919, at St. Saviour's Church, Claremont, Captain John Hare, R.A.M.C., second son of Mr. and Mrs. Samuel Hare, of Howlish Hall, Bishop Auckland, co. Durham, England, to Katherine Dora (Kitty), eldest daughter of Mr. and Mrs. Edward Rowe, of Muizenberg.

DEATH.

HEFFERNAN.—On May 18, 1919, at Seskin, Clonmel, co. Tipperary, Ireland, Lieut.-Col. W. Heffernan, late R.A.M.C., aged 62 years.

A free issue of twenty-five reprints will be made to contributors of Original Communications, and of twenty-five excerpts of Lectures, Travels and Proceedings of the United Services Medical Society.

Any demand for reprints, additional to the above, or for excerpts, must be forwarded at the time of submission of the article for publication, and will be charged for at the following rates, and additional copies at proportionate rates:—

Number of Reprints	Number of Pages	Cost of Reprints	Cost of Excerpts*	Extra for Covers for Reprints: As Journal, Printed on Front	Extra for Covers for Reprints: As Journal, Plain, Unprinted	Extra for Covers for Reprints: Cheaper Paper, Printed on Front	Extra for Covers for Reprints: Cheaper Paper, Plain, Unprinted
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12	4	0 2 9	0 1 2	4 3	1 1	3 10	0 9
	8	0 5 0	0 2 3				
	16	0 8 3	0 3 11				
25	4	0 3 4	0 1 5	4 10	1 6	4 4	0 11
	8	0 6 0	0 2 9				
	16	0 10 6	0 5 0				
50	4	0 4 6	0 1 10	6 0	2 1	4 10	1 2
	8	0 7 6	0 3 6				
	16	0 13 3	0 5 10				
100	4	0 6 0	0 3 1	7 10	3 11	6 7	2 5
	8	0 10 0	0 4 10				
	16	0 18 6	0 7 6				
200	4	0 9 6	0 4 5	10 10	7 6	9 0	4 10
	8	0 15 0	0 6 7				
	16	1 6 0	0 9 8				

* These are not arranged as Reprints, but appear precisely as in the Journal with any other matter that may happen to appear on the first and last pages of the particular excerpt **ordered.**

CASES FOR BINDING VOLUMES.—Strong and useful cases for binding can be obtained from the publishers at the undermentioned rates:—

Covers, 2s. 6d. net; binding, 2s. 6d.
These charges are exclusive of cost of postage.

In forwarding parts for binding the name and address of sender should be enclosed in parcel.

The above figures are subject to 25 per cent increase.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are inserted free of charge to subscribers and members of the Corps. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS," 324, Adastral House, Victoria Embankment, E.C. 4.

A communication has been received from Major F. C. Pybus.

The following publications have been received:—

British: The Medical Journal of Australia, The Medical Press, The Practitioner, Proceedings of the Royal Society of Medicine, Guy's Hospital Gazette, The Hospital, The Royal Engineers' Journal, Proceedings of the Royal Society of Medicine, Public Health, Veterinary Review, The Indian Medical Gazette, The Journal of Tropical Medicine and Hygiene, St. Bartholomew's Hospital Gazette, Edinburgh Medical Journal, Tropical Diseases Bulletin, Bulletin of the Canadian Army Medical Corps, Agricultural Research Institute, Pusa, The Journal of State Medicine.

Foreign: Bulletin de l'Institut Pasteur, Archives de Médecine et Pharmacie Navales, Bulletin of the Johns Hopkins Hospital, Le Caducée, Annales d'Hygiène et de Médecine Coloniale, Colonies et Marine, Bulletin de la Société de Pathologie Exotique, Revista de la Sanidad Militar, L'Ospedale Maggiore, The Journal of Infectious Diseases, Giornale di Medicina Militare, Bulletins et Mémoires de la Société Médicale des Hôpitaux, War Medicine.

MANAGER'S NOTICES.

The JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is published monthly, six months constituting one volume, a volume commencing on 1st July and 1st January of each year.

The Annual Subscription is £1 (which includes postage), and should commence either on 1st July or 1st January; but if a subscriber wishes to commence at any other month, he may do so by paying for the odd months between 1st July and 1st January at the rate of 1s. 8d. (one shilling and eightpence) per copy. (All subscriptions are payable in advance.)

Single copies can be obtained at the rate of 2s. per copy.

The Corps News is also issued separately from the Journal, and can be subscribed for at the rate of 2s. (two shillings) per annum, including postage. Subscriptions should commence from 1st July each year; but if intending subscribers wish to commence from any other month, they may do so by paying for the odd months at the rate of 2d. per copy. (All subscriptions are payable in advance.)

Officers of the Royal Army Medical Corps possessing Diplomas in Public Health, etc., are kindly requested to register their special qualifications at the War Office. Letters of complaint are frequently received from officers stating that their special qualifications have not been shown in the Distribution List which is published as a supplement to the Journal in April and October of each year. As, however, the particulars of this list are supplied from official sources, officers are reminded that unless the possession of Diplomas, etc., has been registered at the War Office, no entry of such qualifications can be recorded in the Distribution List.

Letters notifying change of address should be sent to the Hon. Manager, "Journal of the Royal Army Medical Corps," 25, Adastral House, Victoria Embankment, E.C. 4, and must reach there not later than the 20th of each month for the alteration to be made for the following month's issue.

It is requested that all Cheques or Postal Orders for Subscriptions to the Journal, Corps News, Reprints, etc., be crossed "Holt & Co.," and made payable to the "Hon. Manager, Journal R.A.M.C.," and not to any individual personally.

All communications for the Hon. Manager regarding subscriptions, etc., should be addressed to

THE HON. MANAGER,
"JOURNAL OF THE ROYAL ARMY MEDICAL CORPS,"
25, ADASTRAL HOUSE, VICTORIA EMBANKMENT, E.C.4.